HITACHI
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HiCommand® Dynamic Link Manager (HDLM) for Windows Systems

User's Guide

MK-92DLM129-13

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MK-92DLM129-13	June 2007	Revision 13, supersedes and replaces MK-92DLM129-12

Preface

The *HiCommand Dynamic Link Manager (HDLM) for Windows Systems User's Guide* describes and provides instructions for installing the HDLM software on a Windows system and using HDLM with the TagmaStore USP, TagmaStore AMS/WMS Series, Hitachi Lightning 9900 V Series, Lightning 9900, and/or Thunder 9200, 5800, or 5700E disk array systems.

This user's guide assumes that:

- The user has a background in data processing and understands direct-access storage device systems and their basic functions,
- The user is familiar with the Hitachi disk array system(s) (e.g., Lightning 9900 V Series, Hitachi Thunder 9200), and
- The user is familiar with the Windows 2000 or Windows 2003 Server operating system, file system, system commands, and utilities.

Notes:

- The term 9900V refers to the entire Lightning 9900 V Series system family (e.g., 9980V, 9970V), unless otherwise noted. For further information, refer to the *Hitachi Freedom Storage Lightning 9900 V Series User and Reference Guide* (MK-92RD100).
- The term "9900" refers to the entire Lightning 9900 system family (e.g., 9960, 9910), unless otherwise noted. For further information, refer to the *Hitachi Freedom Storage Lightning 9900 User and Reference Guide* (MK-90RD008).
- The term "9500V" refers to the entire Thunder 9500 V Series system family unless otherwise noted. For further information, refer to the *Hitachi Freedom Storage Thunder 9500 V Series User and Reference Guide* (MK-92DF601).
- For further information on the Hitachi Thunder 9200 system family, refer to the *Hitachi Freedom Storage Thunder 9200 User and Reference Guide* (MK-90DF504).

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HDLM Software Version

This document revision applies to HDLM version 5.9.1.

Convention for Storage Capacity Values

This document uses the following convention for storage capacity values:

1 KB = 1,000 bytes
1 MB = $1,000^2$ bytes
1 GB = $1,000^3$ bytes
1 TB = $1,000^4$ bytes

Referenced Documents

- *Hitachi Lightning 9900 V Series User and Reference Guide*, MK-92RD100
- *Hitachi Lightning 9900 V Series Windows NT Configuration Guide*, MK-92RD120
- *Hitachi Lightning 9900 V Series Windows 2000 Configuration Guide*, MK-92RD121
- *Hitachi Lightning 9900 User and Reference Guide*, MK-90RD008
- *Hitachi Lightning 9900 Windows NT Configuration Guide*, MK-90RD015
- *Hitachi Lightning 9900 Windows 2000 Configuration Guide,* MK-90RD025
- *Hitachi Thunder 9500 V Series User and Reference Guide*, MK-92DF601
- *Hitachi Thunder 9200 User and Reference Guide*, MK-90DF504
- *Hitachi Thunder 9200 Windows NT Host Install Guide (FIBRE),* MK-91DF521
- *Hitachi Thunder 9200 Windows 2000 Host Install Guide (FIBRE),* MK-91DF515
- *Hitachi Freedom Storage 5000 Series Software Configuration User's Guide*, BO-98DF376

Comments

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Chapter 1 Overview of HDLM

This chapter provides an overview of HDLM and describes its features. The overview is broken down into the following sections:

- What is HDLM? (see section 1.1)
- HDLM features (see section 1.2)
- HDLM GUI Overview (see section 1.3)

1.1 What is HDLM?

The widespread use of data warehousing and increasing use of multimedia data have increased the need for high-speed processing of large volumes of data on networks. To satisfy this need, networks dedicated to data transfer, such as a SAN, are now being used to provide access to storage systems.

The HDLM software manages access paths to storage systems. HDLM provides functionality for distributing the load across paths and switching to another path if there is a failure in a path being used, thus improving system availability and reliability.

Figure 1.1 illustrates the connections between hosts and storage systems. A server on which HDLM is installed is called a *host*.

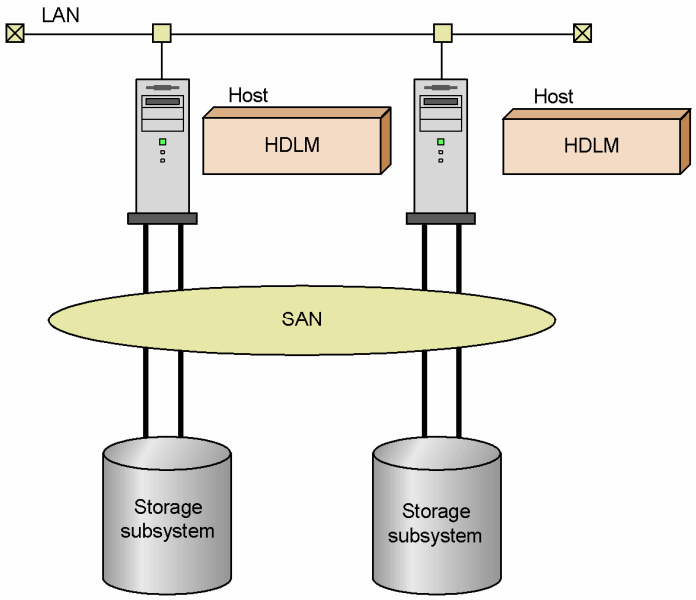


Figure 1.1 Connections Between Hosts and Storage Systems

HDLM supports the following storage systems:

- TagmaStore USP
- Universal Storage Platform V
- TagmaStore AMS/WMS series
- Lightning 9900V Series
- Lightning 9900 Series
- Thunder 9500V Series
- Thunder 9200
- EMC DMX series

- EMC CX series
- HP EVA series

1.2 HDLM Features

HDLM provides the following features:

Distributes the load across paths (*load balancing*)

When multiple paths connect a host and storage system, HDLM distributes the load across the paths. This prevents a heavily loaded path from affecting processing speed.

For details on load balancing, see section 2.6.

Allows processing to continue if there is a failure (*failover*)

When multiple paths connect a host and storage system, HDLM automatically switches to another path if there is a failure in a path being used. This allows processing to continue without being affected by the failure.

For details on failover, see section 2.7.

Allows you to place online a path recovered from an error (*failback*)

When a path recovers from an error, HDLM can place the path online. This enables the maximum number of paths to be online, which in turn enables HDLM to distribute the load for each path.

Route failbacks can be performed manually or automatically. In an automatic failback, HDLM automatically restores the route to the active state after the user has corrected the problem in the physical route.

For details on failback, see section 2.7.

Automatically checks the path status at regular intervals (*path health checking*)

HDLM can detect errors by checking the status of the paths at user-defined time intervals. This allows you to check for any existing path errors and to resolve them accordingly.

For details on path health checking, see section 2.9.

Allows you to use a GUI to operate HDLM visually (HDLM GUI)

HDLM uses a configuration-diagram or list format to display information about paths between hosts and Hitachi storage systems. You can use the GUI to change the status of a path, and to set the operating environment.

For details on the HDLM GUI, see sections 4.2 and 6.1.

1.3 HDLM GUI Overview

HDLM GUI has the following windows:

- Path Management window
- Options window
- Help window

1.3.1 About the Path Management Window

Use the Path Management window to view path information and change path status.

Figure 1.2 shows the Path Management window.

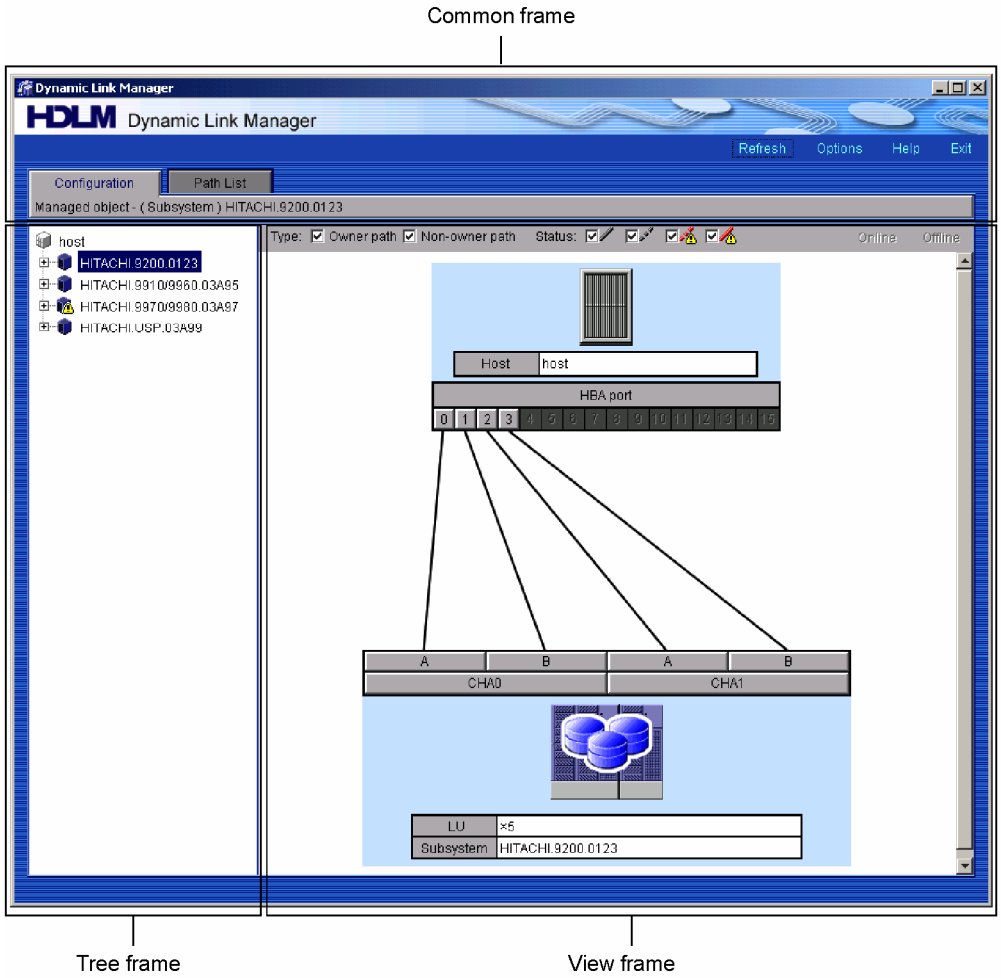


Figure 1.2 Path Management Window

The Path Management window consists of three frames shown in Figure 1.2:

- Common frame

  Displays the title, logo, and buttons that are used throughout the HDLM GUI.

- Tree frame

  Displays in tree format the storage systems and LUs that are managed by the host.

- View frame

  Displays the path configuration view or path list view.

1.3.2 About the Options Window

Use the Options window to view or change an HDLM operating environment.

Figure 1.3 shows the Options window.

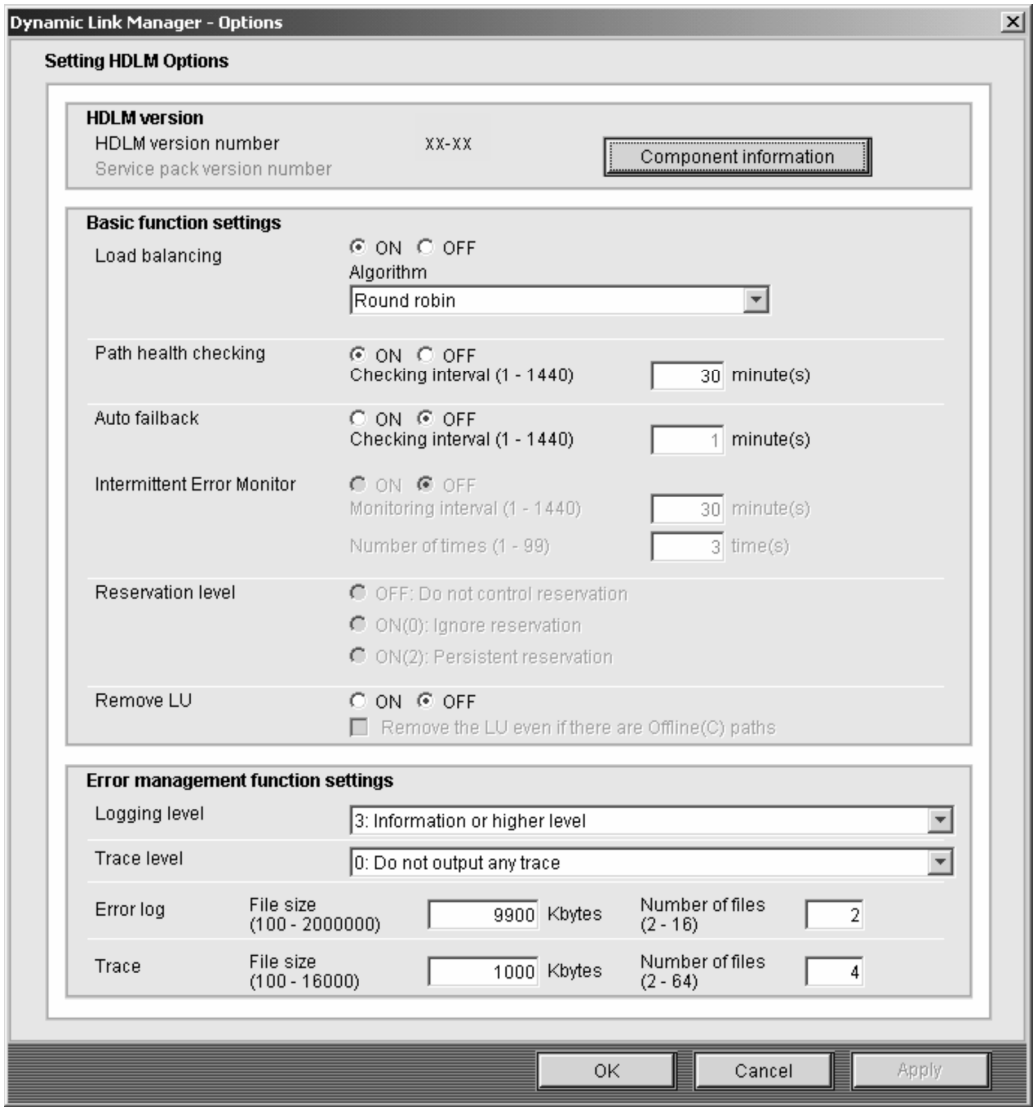


Figure 1.3 Options Window

1.3.3 About the Help Window

Use the Help window to view the HTML version of this manual.

Chapter 2 HDLM Functions

This chapter describes HDLM functionality including HDLM management targets, system configuration, basic terms and functionality including load distribution across paths and path switching. HDLM functionality is discussed in the following sections:

- Devices managed by HDLM (see section 2.1)
- System configuration (see section 2.2)
- LU configuration (see section 2.3)
- Program configuration (see section 2.4)
- HDLM and MPIO driver position (see section 2.5)
- Load distribution using load balancing (see section 2.6)
- Failover and failback using path switching (see section 2.7)
- Monitoring intermittent errors (see section 2.8)
- Detecting errors by using path health checking (see section 2.9)
- Dynamic reconfiguration (see section 2.10)
- Error management (see section 2.11)
- Cluster support (see section 2.12)

2.1 Devices Managed by HDLM

Devices that can and cannot be managed by HDLM are shown below. The devices that can be managed by HDLM are called HDLM management-target devices.

Devices that HDLM can manage:

- SCSI devices for Hitachi storage systems
- Hitachi storage system command devices, such as Hitachi RAID Manager command devices
- EMC DMX series, EMC CX series, and HP EVA series

  However, only the following operating systems can manage the EMC DMX series, EMC CX series, and HP EVA series:

  - Windows Server 2003 (IA32) SP1 or later
  - Windows Server 2003 (IPF) SP1 or later

Devices that HDLM cannot manage:

- SCSI devices other than those for Hitachi storage systems (other than the EMC DMX series, EMC CX series, and HP EVA series)
- Built-in disks in a host
- Devices other than disks (tape devices, etc.)

2.2 System Configuration

HDLM is available in two SAN environment types: FC-SAN and IP-SAN. However, a single host can connect to either the FC-SAN or IP-SAN. Note that the EMC DMX series, EMC CX series, and HP EVA series is available only in an FC-SAN environment.

2.2.1 System Configuration Using an FC-SAN

In an FC-SAN, fiber cables connect hosts and storage systems. The cable port on the host is a *host bus adapter* (HBA). The cable port on the storage system is a *port* (P) on a *channel adapter* (CHA).

A *logical unit* (LU) contained in a storage system is the target of input to, or output from, the host. An area in an LU is called a *Dev*.

A route that connects a host and a Dev in an LU is called a *path*.

HDLM assigns an ID to the management-target path. This ID is called a *path management PATH_ID*. Also, the path might be called a *management target*.

Figure 2.1 shows the HDLM system configuration using the FC-SAN.

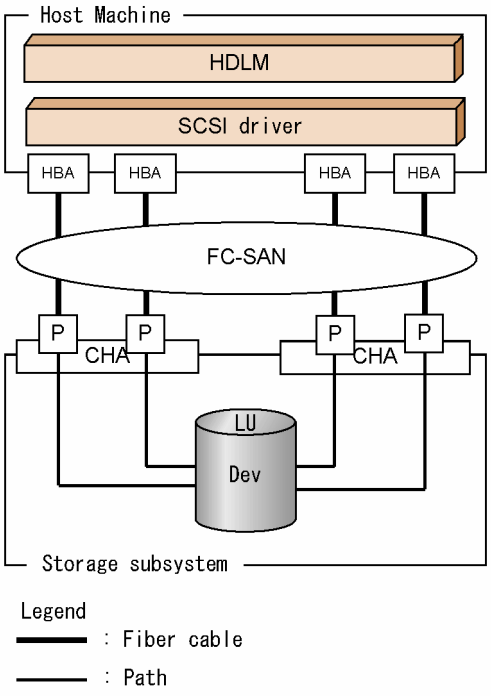


Figure 2.1 HDLM System Configuration Using FC-SAN

Table 2.1 lists the HDLM system components using the FC-SAN.

Table 2.1 HDLM System Components Using FC-SAN

Components	Description
HBA	A host bus adapter. This serves as a cable port on the host.
FC-SAN	A dedicated network that is used for data transfer between hosts and storage systems.
CHA	A channel adapter.
P	A port on a channel adapter. This serves as a cable port on a storage system.
LU	A logical unit with which the host can perform input or output operations. This unit can be accessed from the network.
Dev	A logical area (a partition) in an LU.
Path	A route that connects a host and a Dev in an LU.

2.2.2 System Configuration Using an IP-SAN

In an IP-SAN, LAN cables are used to connect hosts and storage systems. The cable port on the host is an iSCSI host bus adapter (iSCSI HBA) or a network interface card (NIC). When using an NIC, the iSCSI software must be installed in advance on the host. The cable port on the storage system is a port (P) on a channel adapter used for iSCSI connections (CHA).

A logical unit (LU) contained in a storage system is the target of input to, or output from, the host. An area in an LU is called a *Dev*.

A route that connects a host and a Dev in an LU is called a *path*.

HDLM assigns an ID to the management-target path. This ID is called a path management PATH_ID. Also, the path might be called a management target.

Figure 2.2 shows the IP-SAN system configuration using an iSCSI HBA. Figure 2.3 shows the IP-SAN system configuration using the iSCSI software and an NIC.

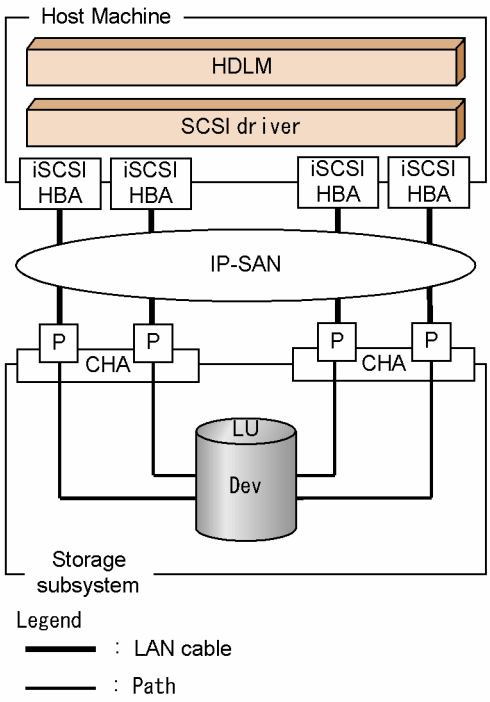


Figure 2.2 IP-SAN System Configuration Using iSCSI HBA

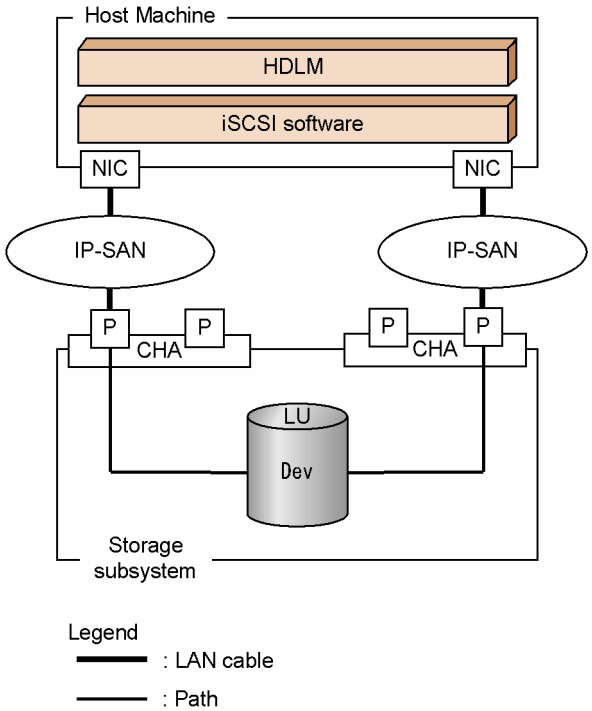


Figure 2.3 IP-SAN System Configuration Using iSCSI Software and NIC

Table 2.2 lists the HDLM system components that use the IP-SAN.

Table 2.2 HDLM System Components that use IP-SAN

Components	Description
iSCSI software	The driver software that has the iSCSI initiator function.
iSCSI HBA	A host bus adapter that has the iSCSI initiator function. This serves as a cable port on the host. The *iSCSI HBA* is referred to as the *HBA* in HDLM commands and HDLM GUI. It is sometimes called an *HBA* in this manual.
NIC	A network interface card that serves as a cable port on a host. The *NIC* is referred to as the *HBA* in HDLM commands, and HDLM GUI. It is sometimes called an *HBA* in this manual.
IP-SAN	A data transfer network that connects hosts and storage systems by using the iSCSI standard.
CHA	A channel adapter used for iSCSI connections.
P	A port on a channel adapter. This serves as a cable port on a storage system.
LU	A logical unit with which the host can perform input or output operations. This unit can be accessed from the network.
Dev	A logical area (a partition) in an LU.
Path	A route that connects a host and a Dev in an LU.

2.2.2.1 Setting the Range of iSCSI Software and iSCSI HBA

The following describes the range of settings for the iSCSI software and iSCSI HBA. For notes on setting the values, see the hardware notes supplied with HDLM.

- IP addresses

  Set the same network address for an HBA and a CHA port connected via a path.

- Other settings
  - You can share the IP-SAN with other hosts.
  - A single HBA can connect to multiple CHA ports.

When using the iSCSI software and multiple NICs, connect to the storage system by each NIC using a separate different IP network and different CHA ports for each NIC with the storage system. To view a configuration example, see Figure 2.3.

2.2.2.2 Storage Systems Supported by HDLM

Storage systems applicable to the IP-SAN are the TagmaStore AMS/WMS Series, Hitachi TagmaStore Universal Storage Platform 100, Hitachi TagmaStore Universal Storage Platform 600, Hitachi TagmaStore Universal Storage Platform 1100, TagmaStore NSC 55, and Lightning 9900V Series.

2.3 LU Configuration

When you install HDLM, the LU configuration recognized by the host changes as follows:

- Before installing HDLM:

  In the disk management window of the host, a SCSI device is displayed for each path.

  This means a single LU in the storage system is recognized as the number of LUs that correspond to the number of paths.

- After installing HDLM:

  The MPIO driver integrates the LUs that are recognized for each path. In the disk management window of the host, the disk corresponding one-to-one with an LU in the storage system is displayed.

  This means, from the host, LUs in the storage system are recognized as only one LU regardless of the number of paths.

  In Windows, you can display the SCSI device in the Device Manager windows.

An LU recognized by a host after HDLM installation, is called a *host LU* (HLU). The areas in a host LU that correspond to the Dev in a storage system LU are called *host devices* (HDev).

On a system using HDLM, to access the target LU, a drive letter is assigned to the disk integrated by the MPIO driver (the disk displayed in the disk management window of Windows).

Figure 2.4 shows the LU configuration recognized by the host after HDLM installation.

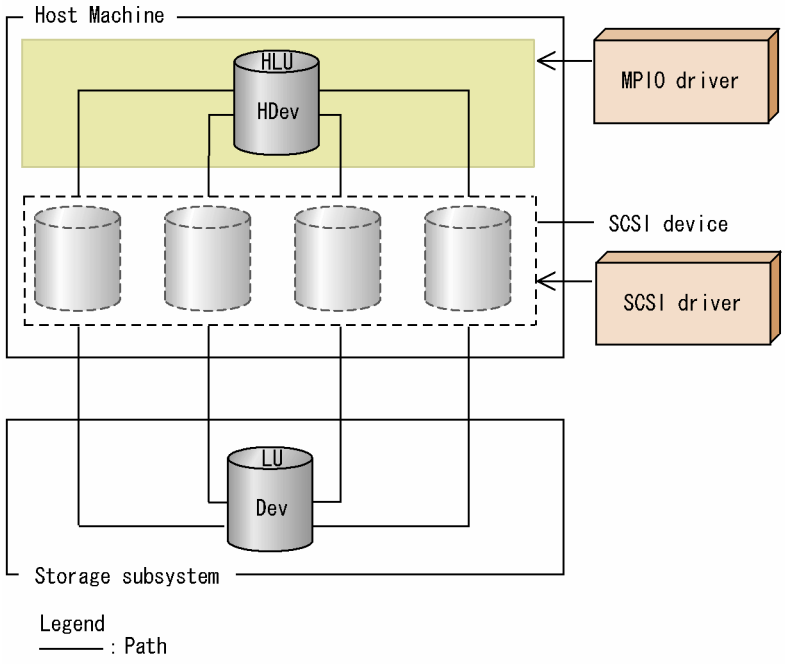


Figure 2.4 LU Configuration Recognized by Host After HDLM Installation

Table 2.3 lists the components recognized by the host.

Table 2.3 Components Recognized by Host

Components	Description
HLU	An LU that the host recognizes via the HDLM driver. It is called a host LU. Regardless of how many paths exist, only one host LU is recognized for the LU in the storage system.
HDev	A Dev in an LU that the host recognizes via the HDLM driver. It is called a host device.

2.4 Program Configuration

HDLM runs as a combination of programs. Because these programs correspond to the HDLM operations, you need to understand the name, position, and role of each program.

Figure 2.5 shows the HDLM program configuration.

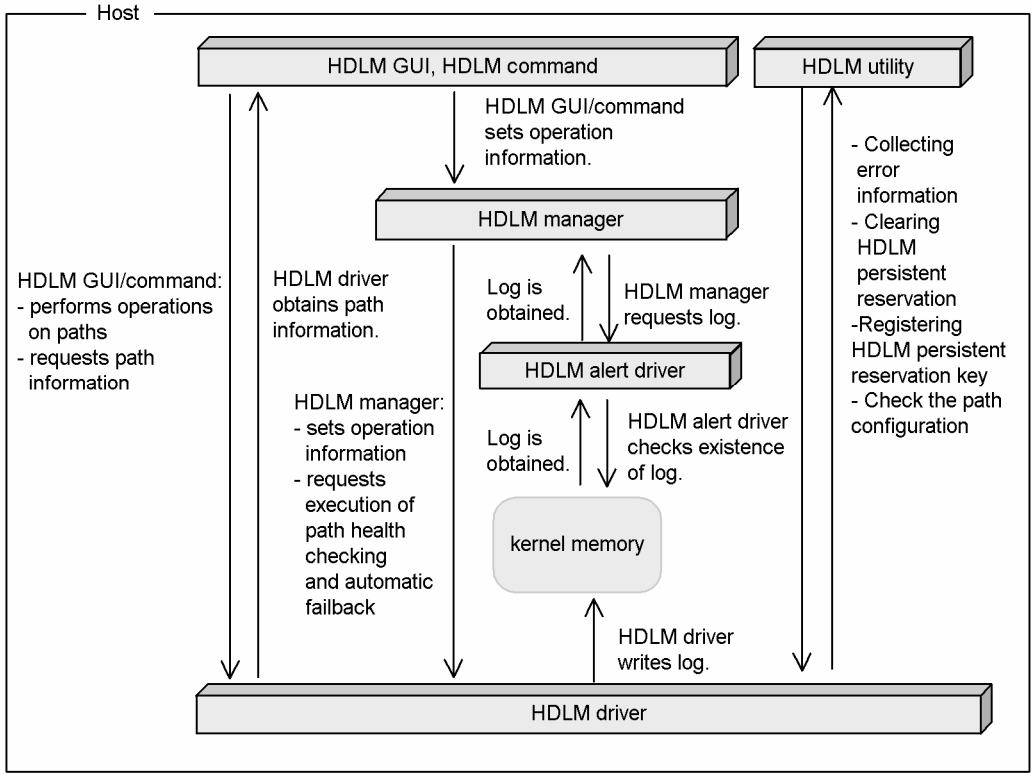


Figure 2.5 HDLM Program Configuration

Table 2.4 lists and describes the functionality of these programs.

Table 2.4 HDLM Program Functionality

Program Name	Functionality
HDLM GUI	Provides a graphical user interface (GUI) to enable you to: ▪ Manage paths ▪ Display error information ▪ Set up the HDLM operating environment
HDLM command	Provides the `dlnkmgr` command to enable you to: ▪ Manage paths ▪ Display error information ▪ Set up the HDLM operating environment
HDLM utility	Provides the HDLM utility to enable you to: ▪ Collect error information ▪ Clear persistent reservations ▪ Register persistent reservation keys ▪ Check the path configuration
HDLM manager	Provides the HDLM manager to enable you to: ▪ Configure the operating environment ▪ Request the execution of path health checks and automatic failback ▪ Collect error log data
HDLM alert driver	Reports the log information collected by the HDLM driver to the HDLM manager.
HDLM driver	Controls HDLM functionality, manages paths, and detects errors. The HDLM driver consists of the following: ▪ Core logic component Controls the basic functionality of HDLM. ▪ Filter component Sends and receives I/O. The driver name is `hdlmdsm.sys`.

2.5 HDLM and MPIO Driver Position

The HDLM and MPIO drivers are positioned above the SCSI driver. Applications on a host access LUs in storage systems through the HDLM and MPIO drivers.

Figure 2.6 shows the positions of the HDLM and MPIO drivers.

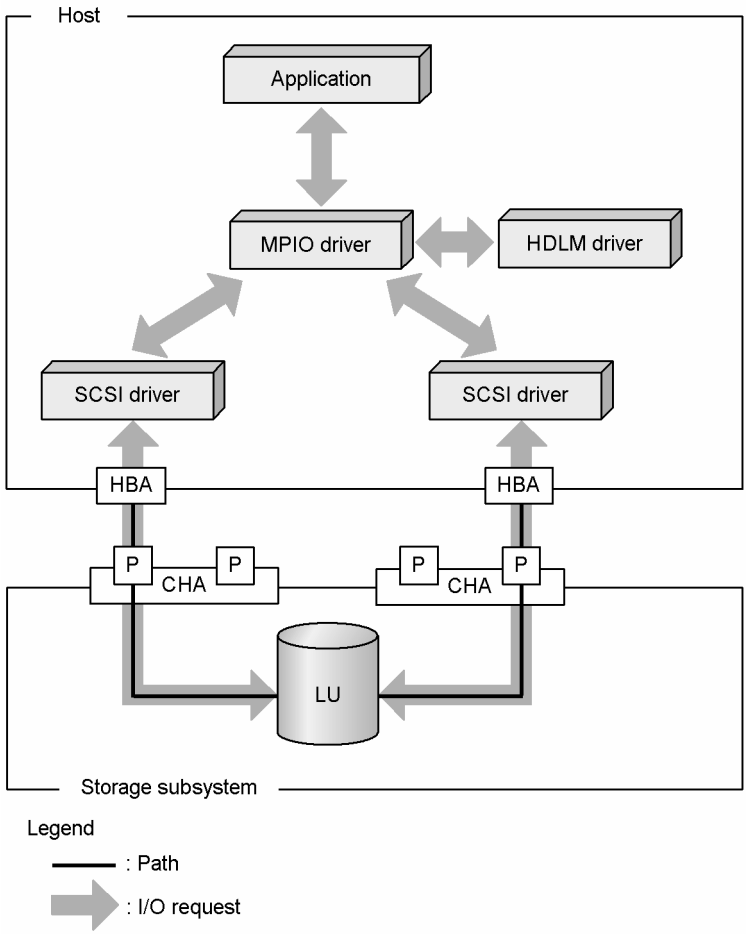


Figure 2.6 Position of HDLM and MPIO Drivers

2.6 Load Distribution using Load Balancing

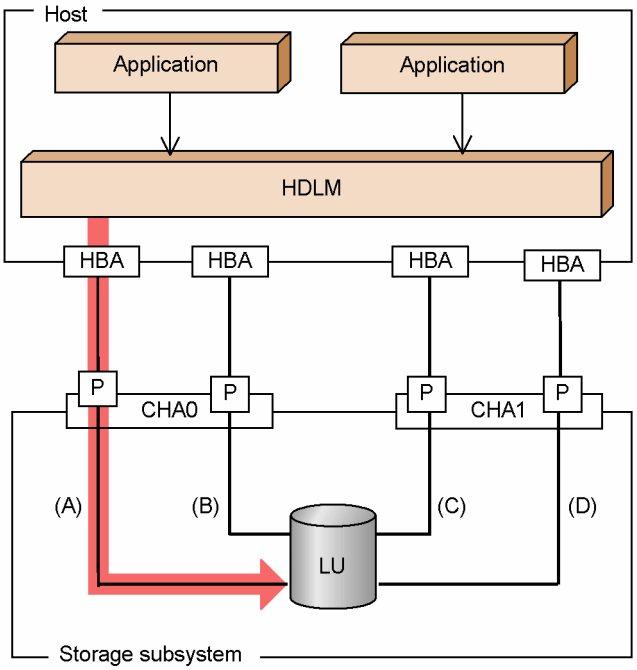
When the system contains multiple paths to an LU, HDLM can distribute the load across the paths by using multiple paths for I/O. This functionality is called load balancing, and it prevents a heavily loaded path from affecting the performance of the entire system.

Note that some I/O operations managed by HDLM can be distributed to each path, while others cannot. Therefore, even when the load balancing function is used, I/O operations may not be equally allocated to each path. For example, when Raid Manager issues IOCTL to a command device, this I/O operation cannot be equally allocated to each path.

Note: Do not use the load balancing function set up in the Microsoft iSCSI Software Initiator user interface.

In a cluster environment, the load balancing function is only available for TagmaStore, Thunder 9200/9500V Series, Lightning 9900/9900V Series, and Universal Storage Platform V. In a non-cluster environment, the load balancing function is available for TagmaStore, Thunder 9200/9500V Series, Lightning 9900/9900V Series, Universal Storage Platform V, and the EMC DMX series. For details on the cluster software supported by HDLM, see section 2.12.

Figure 2.7 shows the I/O flow when the load balancing function is not being used. Figure 2.8 shows the I/O flow when the load balancing function is being used. Both figures show an example of an I/O operation being issued for the same LU from multiple applications.



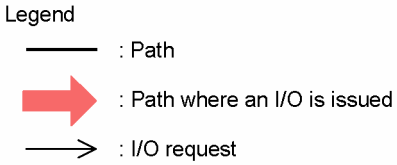


Figure 2.7 I/O Flow When Load Balancing is Not Used

When the load balancing function is not being used, I/O operations converge on one path (A). The load on the path (A) will cause a bottleneck, which might cause deterioration of the whole system's performance.

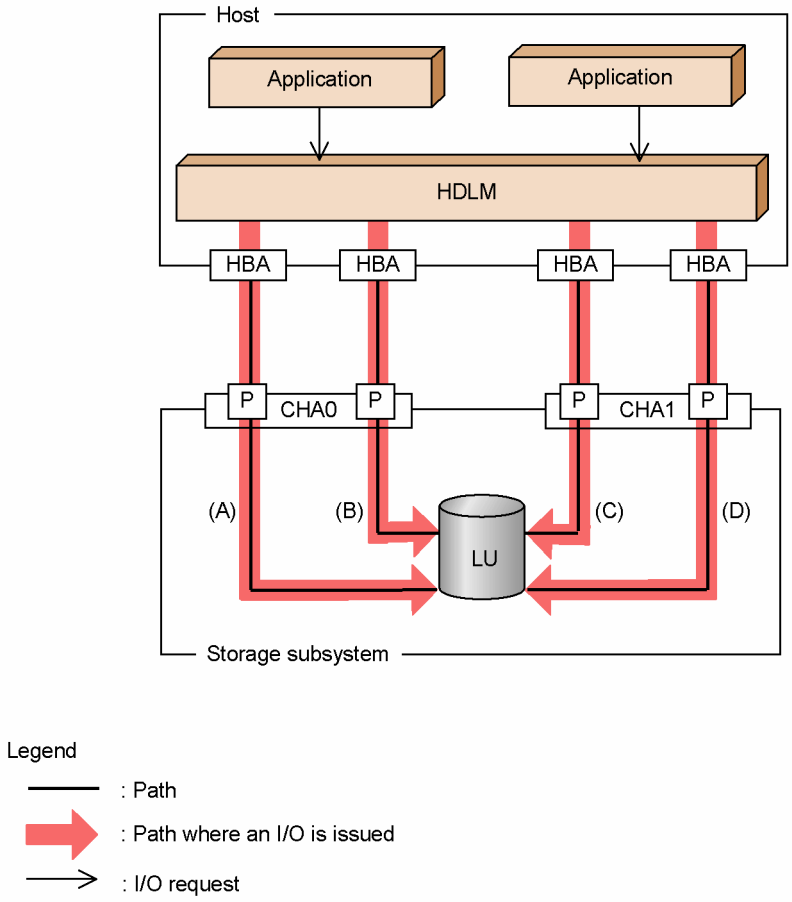


Figure 2.8 I/O Flow When Load Balancing is Used

When the load balancing function is being used, I/O operations are distributed via paths (A), (B), (C), and (D). This prevents deterioration of the whole system's performance from a bottleneck on one path.

2.6.1 Paths to Which Load Balancing is Applied

This section explains the mechanism of load balancing. The explanation uses the example shown in Figure 2.9.

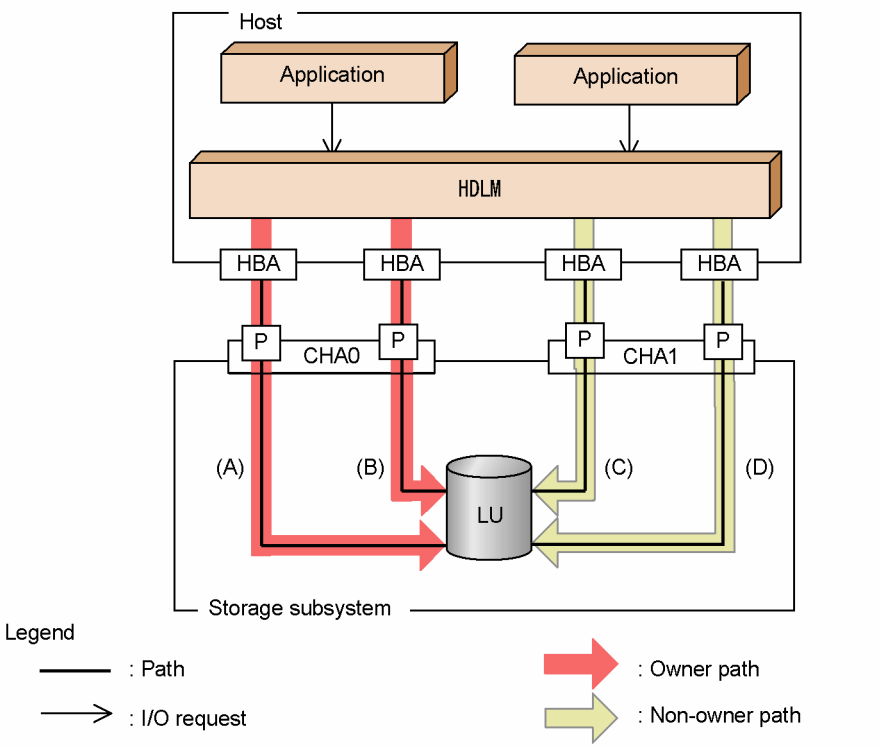


Figure 2.9 Overview of Load Balancing

This subsection describes, for each storage system, the paths to which the load balancing function is applied.

2.6.1.1 Using TagmaStore AMS/WMS Series, Thunder 9500V Series, or Thunder 9200 Series

HDLM performs load balancing between owner paths or between non-owner paths. An *owner path* is a path that passes through the channel adapter. This path is set on the *owner controller* of the storage system LU. When you set an LU, you determine the owner controller and non-owner controller for the LU. Since the owner controller varies depending on the LU, the owner path also varies depending on the LU. A *non-owner path* is a path that uses a channel adapter other than the owner controller (a *non-owner controller*). To prevent performance in the entire system from deteriorating, HDLM does not perform load balancing between owner paths and non-owner paths. When some owner paths cannot be used due to a problem such as a failure, load balancing is performed among the remaining usable owner paths. When no owner paths can be used, load balancing is performed among the non-owner paths.

For the example in Figure 2.9, suppose that the owner controller of LU0 is CHA0. When the LU is accessed, the load is balanced between the paths (A) and (B) (that is, between owner paths). When the path (A) cannot be used due to a problem such as a failure, the LU can only be accessed via the path (B). When the paths (A) and (B) cannot be used, the load is balanced between the paths (C) and (D) (that is, between non-owner paths).

2.6.1.2 When using the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP or Universal Storage Platform V

All the online paths are owner paths. Therefore, for the example in Figure 2.8, when the LU is accessed, the load is balanced among the paths (A), (B), (C), and (D). When one of the paths cannot be used due to a problem such as a failure, the load is balanced among the remaining paths.

2.6.2 Algorithms for Load Balancing

HDLM features the following two algorithms for load balancing:

- Round robin

  Round robin distributes all I/Os among multiple paths.

- Extended round robin

  Extended round robin distributes I/Os to paths depending on the type of the I/O, which can be either sequential access or random access. For sequential access, I/Os are issued to a single path. For random access, I/Os will be distributed to multiple paths.

Table 2.5 describes the types of load balancing (round robin and extended round robin) for each I/O operation type.

Table 2.5 Algorithms for Load Balancing

Algorithm	For Sequential Access	For Random Access
Round robin	After an I/O operation is issued to a path once or a certain number of times, the path is switched to the next path. The storage system cache might not be fully usable. When multiple applications that request sequential access are run concurrently, we recommend that you use the round robin algorithm to distribute I/Os across multiple paths. [1]	
Extended round robin	After an I/O operation is issued to a path a certain number of times in succession, the path is switched to the next path. If sequential access is switched to random access before an I/O operation is issued to a path a certain number of times, the path is switched to the next path when sequential access is switched to random access. The storage system cache can be used. When you execute only a single application that requests sequential access (such as a batch job running at night) we recommend that you use the extended round robin algorithm. [1]	After an I/O operation is issued to a path once or a certain number of times, the path is switched to the next path.

[1]The recommended algorithm depends on the type of application, and the operations policy.

You can specify the load balancing function from the Options window of the HDLM GUI or by the `dlnkmgr` command's `set` operation. For details on how to use the window components, see section 4.2.8 or 6.3. For details on the `set` operation, see section 7.6.

Note: Some I/O operations managed by HDLM can be distributed across all paths, and some cannot. Thus, you should be aware that even when you use the load balancing function, I/O operations cannot always be allocated uniformly across all paths.

When using MSCS, depending on the micro-program of the storage system, you may not be able to use the load balancing function. For more details, see the hardware notes provided with HDLM.

2.7 Failover and Failback Using Path Switching

When the system contains multiple paths to an LU and an error occurs in the path being used, HDLM can switch to another normal path to allow the system to continue to operate. This functionality is called *failover*.

When the path in which an error occurred recovers from the error, HDLM can switch the paths so that the recovered path is used. This functionality is called *failback*.

Two types of failover and failback are available:

- Automatic path switching
- Manual path switching

Failover and failback change the path statuses and switch the paths. Path statuses are classified into *online* statuses and *offline* statuses. Online statuses allow the path to normally receive I/Os. Offline statuses prevent the path from receiving I/Os for the following reasons:

- An error occurred in the path.
- A user placed the path offline using the Path Management window of the HDLM GUI.
- A user executed the HDLM command's `offline` operation.

  For details on the `offline` operation, see section 7.4.
- Hardware such as cables or HBAs is removed.

For details on path statuses and the status transitions, see section 2.7.3.

Note: When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200, make sure that you set the data share mode to **ON** (**Used**). For details on the data share mode, see the manual for the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200.

2.7.1 Automatic Path Switching

The following describes the automatic failover and automatic failback functionalities that automatically switch a path.

2.7.1.1 Automatic Failover

If you detect an error for a path in use, you can keep operating the system by changing the state to offline, and using other online paths. This functionality is called *automatic failover*. Automatic failover is applicable to the following levels of errors that occur on a path:

- Critical: A fatal error that may stop the system.
- Error: A high-risk error that can be avoided by using failover or other countermeasures.

For details on error levels, see section 2.11.2.

When TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200 are being used, HDLM selects the switching destination from the paths that access the same LU, in the order of owner paths and non-owner paths. For example, in Figure 2.10, the owner controller of LU is CHA0, and access to the LU is made only via the path (A). After the access path is placed offline, the first candidate for the switching destination is the path (B) and the second candidate is the path (C) or (D).

When the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V is being used, all the paths are owner paths. This means all the paths accessing the same LU can be possible switching destinations. For example, in Figure 2.10, the LU is accessed using only the path (A). After the access path is placed offline, the switching destination is one of the paths (B), (C), and (D).

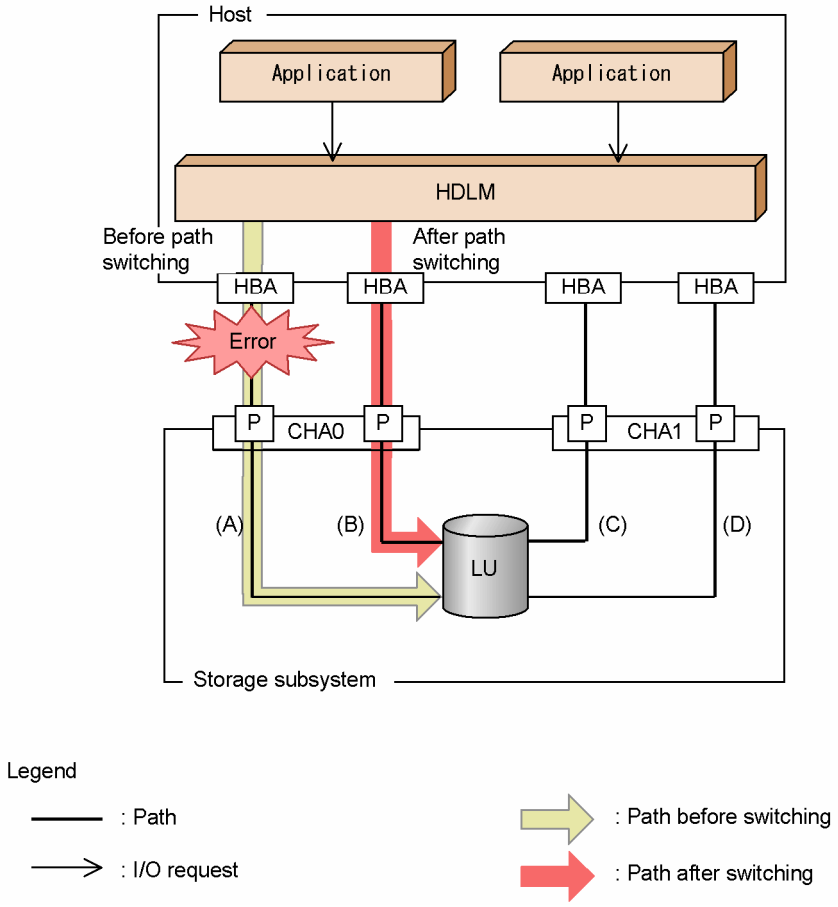


Figure 2.10 Path Switching

2.7.1.2 Automatic Failback

After a path recovers from an error, HDLM can automatically place the recovered path online. This functionality is called *automatic failback*.

When using this function, HDLM monitors error recovery on a regular basis.

When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200, HDLM selects the path to use from online owner paths, and then from online non-owner paths. Therefore, if an owner path recovers from an error and HDLM automatically places the recovered path online while any non-owner path is in use, the path to use is switched to the owner path.

When the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V is being used, all the paths are owner paths. Therefore, if an owner path recovers from an error and HDLM automatically places the recovered path online, the path to use is not switched.

An intermittent error is an error that occurs irregularly because of some reason such as a loose cable connection. When intermittent errors occur in paths, the path status may frequently alternate between the online and offline status if you are using automatic failback, so the I/O performance might deteriorate. In such a case, if there is a path in which an intermittent error might be occurring, we recommend that you set up intermittent error monitoring to remove that path from those subject to automatic failback.

You can specify the automatic failback function or intermittent error in the Options window of the HDLM GUI or by the `dlnkmgr` command's `set` operation. For details on the operation in the Options window, see sections 4.2.8 and 6.3. For details on the `set` operation, see section 7.6.

2.7.2 Manual Path Switching

You can switch a path by manually placing a path online or offline. Manually switching a path temporarily is useful for maintenance of the system.

You can manually place a path online or offline in the following ways:

- Use the Path Management window of the HDLM GUI.
- Execute the `dlnkmgr` command's `online` or `offline` operation.

  For details on the `online` operation, see section 7.5. For details on the `offline` operation, see section 7.4.

However, the status of the last path for a specific LU in offline status cannot be manually switched to offline. Also, the status of a path whose error has not been recovered cannot be switched to online.

HDLM selects the switching destination path the same way as for automatic path switching.

When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200, HDLM selects the switching destination path from owner paths and then from non-owner paths. When the Lightning 9900 Series, Lightning 9900V,TagmaStore USP, or Universal Storage Platform V is being used, all paths that access the same LU are candidates for the switching destination path. All other paths that run through the same path are switched.

Changing the path status online in the Path Management window, or executing the `online` operation places the offline path online. For details on the `online` operation, see section 7.5. After the path status is changed to online (by using the Path Management window or by executing the `online` operation), HDLM selects the path to use in the same way as for automatic path switching. When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200, HDLM selects the path to use from online owner paths, and then from online non-owner paths. When the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V is being used, since all the paths are owner paths, the path to use is not switched even if you change the path status to online by using the Path Management window or the `online` operation.

For details on the operation for changing the path status in the Path Management window, see sections 4.2.6 and 6.2. For details on the `offline` and `online` operations, see sections 7.4 and 7.5.

2.7.3 Path Status Transition

This section explains the online and offline path statuses described in section 2.7. There are four types of online status, and three types of offline status. A description of each type of status is provided below. In the descriptions, an offline operation refers to performing an offline operation using the Path Management window in HDLM GUI or by executing the `dlnkmgr` command's `offline` operation. For details on the `offline` operation, see section 7.4.

2.7.3.1 The Online Path Status

The online path statuses are as follows:

- `Online`

  I/O can be issued normally.

- `Online(P)`

  A state in which offline processing, for a path in the `Online` status, is in the waiting-to-execute status.

  This status occurs in a cluster configuration only.

  The `Online(P)` status indicates that the user performed an offline operation on an `Online` path that is connected to an LU for which reserve processing was being performed. I/O operations can be issued normally until such reserve processing finishes. After the reserve processing finishes, the offline operation is performed and the path status becomes `Offline(C)`.

  The (P) indicates the *pending* attribute, which indicates that the offline operation on the path has a waiting-to-execute status.

- `Online(E)`

  An error has occurred on the path and, among the paths that access the same LU, none of those are in the `Online` status.

  If none of the paths accessing a single LU are in the `Online` status, one of the paths is changed to the `Online(E)` status. This ensures that the LU can be accessed, by making sure that all paths are not offline.

  The (E) indicates the error attribute, which indicates that an error occurred in the path.

- `Online(EP)`

  The status of an `Offline(P)` path changes to `Online(EP)` when the path goes through the following process during reserve processing in a cluster configuration:

  - When two paths are connected to an LU, and then the user performs an offline operation on the `Offline(E)` path to change it to `Offline(P)`.

    The other path is `Online(E)`.

  - When one of the paths is `Offline(P)`, the other path is `Online(E)`, and HDLM detects an error in the `Online(E)` path, then the path statuses change as follows:

    The `Online(E)` path changes to `Offline(E)`.

The Offline(P) path changes to Online(EP).

If the reserve processing finishes after the path has changed from Online(EP) to Offline(P), the offline operation ends successfully and the path changes to Offline(C).

If the reserve processing finishes while the path is Online(EP), the offline operation fails and the path changes to Online(E).

2.7.3.2 The Offline Path Status

The offline path statuses are as follow:

- Offline(C)

  The path is offline because an offline operation was performed.

  The (C) indicates the command attribute, which indicates that the path was placed offline by using the GUI or a command.

- Offline(E)

  The status in which I/O cannot be performed because an error occurred in the path.

  The (E) indicates the error attribute, which indicates that an error occurred in the path.

- Offline(P)

  This status occurs in a cluster configuration only.

  The Offline(P) status indicates that the user performed an offline operation on an Offline(E) path that was connected to an LU for which reserve processing was being performed. After the reserve processing finishes, the offline operation is performed and the path status becomes Offline(C).

  The (P) indicates the *pending* attribute, which indicates that the offline operation on the path has a waiting-to-execute status.

2.7.3.3 Status Transitions of a Path

Figure 2.11 shows the status transitions of a path.

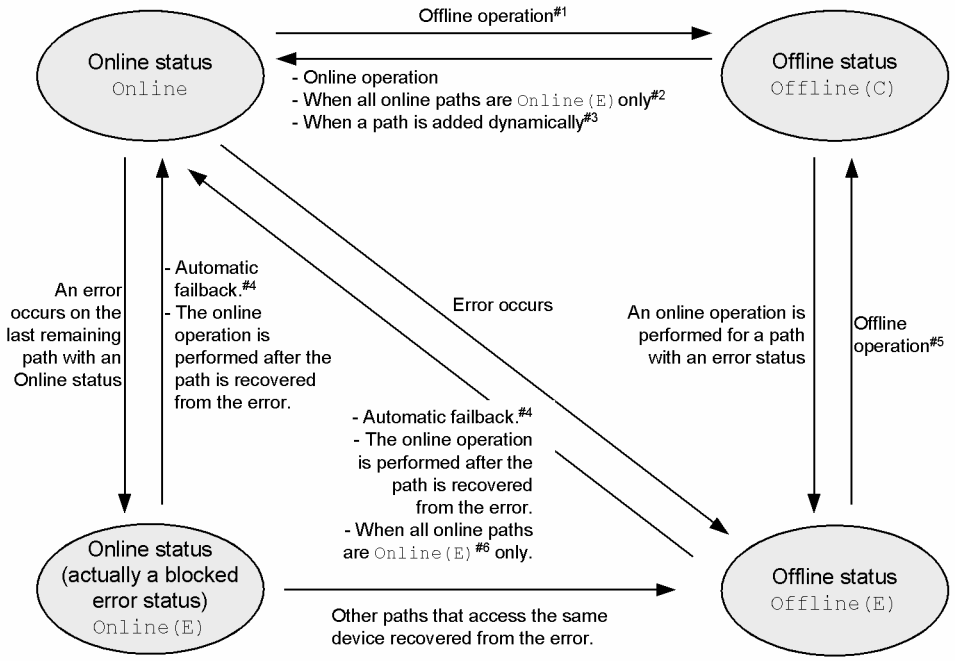


Figure 2.11 Path Status Transitions

Legend:

Online operation: Online operation performed in the Path Management window or by executing the `dlnkmgr` command's `online` operation.

Offline operation: Offline operation performed in the Path Management window or by executing the `dlnkmgr` command's `offline` operation.

#1: During reservation processing for an LU, the Online status is temporarily changed to Online(P). When the reservation processing finishes, the Online(P) status is changed to Offline(C).

#2: When the following conditions are satisfied, the connected Offline(C) paths are automatically placed online:

- All the online paths are Online(E) and SCSI devices connected to the Online(E) paths have been deleted.
- SCSI devices are connected and all Offline(E) paths are subject to automatic failback.
- SCSI devices are connected to the Offline(C) paths.

#3: When a path is added dynamically, initially the path status is Offline(C). The path status will then automatically change to Online. For details on the path dynamic addition functionality, see 4.6.1.

#4: When the following conditions are satisfied, a path that has been determined to have an intermittent error also becomes subject to automatic failback:

- All the paths connected to an LU are Online(E), Offline(E), or Offline(C).
- All the paths connected to an LU have been determined to have an intermittent error.
- The processing of continuous I/O operations issued to an LU is successful.

#5: During reservation processing for an LU, the Offline(E) status is temporarily changed to Offline(P). When the reservation processing finishes, the Offline(P) status is changed to Offline(C).

#6: When the following conditions are satisfied, the connected Offline(E) paths are automatically placed online:

- All the online paths are Online(E) and SCSI devices connected to the Online(E) paths have been deleted.
- The Offline(E) paths are assumed to have had an intermittent error, and are excluded from automatic failback.
- The SCSI devices are connected to the Offline(E) paths.

The last available online path for each LU cannot be placed offline by using the Path Management window or by executing the `offline` operation. This ensures access to the LU. For details on the `offline` operation, see section 7.4.

If an error occurs in the last available online path for each LU, the status of the path is changed to `Online(E)`.

If you are using automatic failback, when the path recovers from an error, HDLM automatically places the path online. However, there are the following exceptions:

- When you are using intermittent error monitoring, the path in which the intermittent error occurred is not automatically placed online when the path recovers from the error. In such a case, place the path online manually. If the only online path is `Online(E)` when the path is recovered from the error, the path might be placed online automatically. For details, see Figure 2.13.
- There is a case in which the path is automatically placed online even if you are not using the automatic failback function. If you remove the hardware that supports the Windows plug and play function, HDLM places the path offline. Then, HDLM automatically places the path back online when the hardware is re-installed. However, this applies only when there is no other cause for the path being placed offline. Since HDLM automatically places the path online without using the automatic failback function, you do not need to place the path online manually.

When you use the LU dynamic deletion functionality, the path whose status is Online(E) is deleted. Therefore, the path whose status is Online(E) is not displayed in the Path Management window. Also, the `view` operation does not display the path whose status is Online(E).

Note: If there is a path failure immediately after a path is made offline by using an HDLM command or HDLM GUI, Offline(C) might change to Offline(E). If an offline operation was performed, wait for a fixed period of time (about 2 minutes), check the path status by using an HDLM command or HDLM GUI, and make sure that the status has changed to Offline(C). If it is Offline(E), retry the offline operation.

2.8 Monitoring Intermittent Errors

An intermittent error means an error that occurs irregularly because of some reason such as a loose cable connection. I/O performance might decrease when an intermittent error occurs while automatic failback is used, because automatic failback is performed repeatedly. To prevent this phenomenon, HDLM can automatically remove the path where an intermittent error is occurring from those paths subject to automatic failback. This process is called *intermittent error monitoring*.

We recommend that intermittent error monitoring be used along with automatic failback.

With intermittent error monitoring, a path in which an error occurs a specified number of times within a specified interval is determined to have an intermittent error. The path where an intermittent error occurs has an error status until the user places the path online. Failback is not performed for the path. This status is called *not subject to auto failback*.

2.8.1 Checking Intermittent Errors

You can check the path in which an intermittent error occurs by using the execution result of the HDLM command's `view` operation or the HDLM GUI **Path List** view.

For details on the `view` operation, see section 7.7. For details on how to use the **Path List** view of the HDLM GUI and the window components, see sections 4.2.3.2 and 6.2.4.

2.8.2 Setting up Intermittent Error Monitoring

When you use the intermittent error functionality, you can enable or disable the functionality. If you enable the functionality, specify the monitoring conditions: the error monitoring interval, and the number of times that the error is to occur. If an error occurs in a path the specified number of times within the specified error monitoring interval, the system determines that the path has an intermittent error. For example, if you specify 30 for the error monitoring interval and 3 for the number of times that the error is to occur, the path is determined to have an intermittent error if an error occurs 3 or more times in 30 minutes.

You can set up intermittent error monitoring by executing the `dlnkmgr` command's `set` operation or using the Options window of the HDLM GUI.

Intermittent error monitoring can be used only when automatic failback is enabled. The setting value depends on the setting value for automatic failback. For details on how to set up the setting values, see sections 7.6 and 6.3.

2.8.3 Actions for Intermittent Error Monitoring

Intermittent error monitoring is performed for each path,. and it starts when a path is recovered from an error by using automatic failback.

This subsection describes the following actions for intermittent error monitoring:

- When an intermittent error occurs.
- When an intermittent error does not occurs.
- When the conditions for the intermittent error are changed during error monitoring.

2.8.3.1 When an Intermittent Error Occurs

When an error occurs in a path the specified number of times within the specified interval, the error monitoring finishes, the path is determined to have an intermittent error, and then the path is removed from those items subject to automatic failback. The path that is removed from the paths that are subject to automatic failback has an error status until the `online` operation is performed properly. However, if the path satisfies certain conditions, it will be subject to automatic failback and change to online (`Online`). For details on the conditions, see Figure 2.11.

Figure 2.12 shows the action for intermittent error monitoring when an intermittent error occurs. In this example, the path is determined to have an intermittent error when the error occurs 3 or more times in 30 minutes. The event occurred in one path is described on the time arrow.

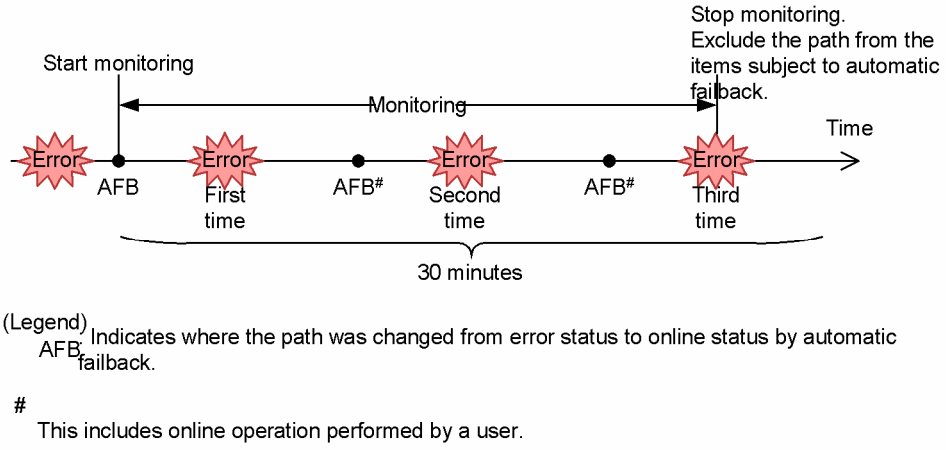


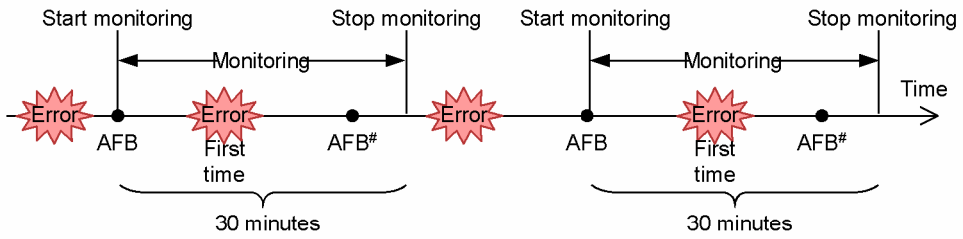
Figure 2.12 Action when an Intermittent Error Occurs in the Path

2.8.3.2 When an Intermittent Error Does Not Occur

If an error does not occur in the path the specified number of times within the specified interval, an intermittent error does not occur. In this case, the error monitoring finishes when the specified error monitoring interval finishes and the number of errors is reset to 0. If an error occurs in the path later, the error monitoring resumes at the time the path is recovered from the error by using automatic failback.

If errors occur after a long interval, an intermittent error can be detected by increasing the error monitoring interval or by decreasing the number of times that the error is to occur (in order for the system to determine that an intermittent error is occurring).

Figure 2.13 shows the action for intermittent error monitoring when an intermittent error does not occur. In this example, the path is determined to have an intermittent error if the error occurs three or more times in 30 minutes. The event occurring in one path is described on the time arrow.



(Legend)
AFB: Indicates where the path was changed from error status to online status by automatic failback.

#
This includes online operation performed by a user.

Figure 2.13 Action When an Intermittent Error does not Occur in the Path

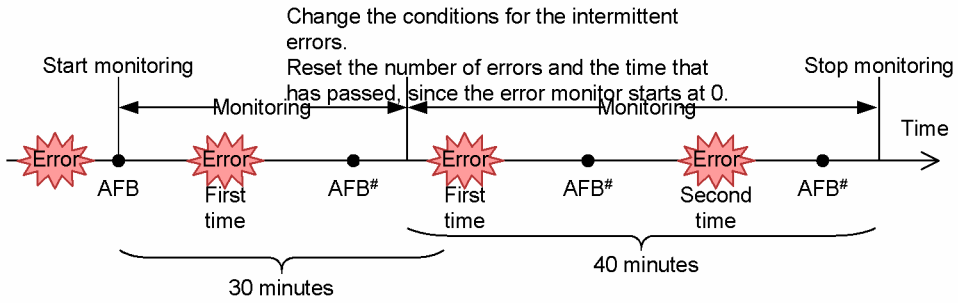
The number of times that the error is to occur is counted when an error occurs. As shown in Figure 2.13, normally the number of times that the error is to occur is counted each time an error occurs after the path is recovered online by automatic failback during intermittent error monitoring. However, if all the paths connected to the LU are in Offline(E), Online(E), or Offline(C) status due to disconnection of the paths or other reasons, the path is not recovered online by automatic failback. If I/O operations are continuously issued to such a LU, the number of times that the error is to occur might be counted even if the path is not placed online. If the number of times that the error is to occur reaches the specified value, the path is determined to have an intermittent error. In such a case, remove the cause of the error, and then manually place the path online.

2.8.3.3 When Conditions for an Intermittent Error Change During Error Monitoring

When the conditions (error monitoring interval and the number of times that the error is to occur) for an intermittent error are changed during error monitoring, the number of errors and the time that has passed since the error monitoring started are reset to 0. The error monitoring does not finish and resumes from the time the conditions are changed.

When you change the conditions outside the error monitoring time, at the time the path is recovered from the error by using automatic failback, the error monitoring starts with the changed conditions.

Figure 2.14 shows the action for intermittent error monitoring when the conditions for an intermittent error are changed during error monitoring. In this example, the conditions have been changed from 3 or more errors in 30 minutes, to 3 or more errors in 40 minutes. The events occurring in one path are written on the time arrow.



(Legend)

AFB: Indicates where the path was changed from error status to online status by AFB.

#

This includes online operation performed by a user.

Figure 2.14 Action Conditions for Intermittent Error Change during Error Monitoring

2.8.4 When User Operations Change Intermittent Error Information

The following might be reset when the user changes the values set for an intermittent error or the path status: the number of errors that are counted during error monitoring, the time that has passed since error monitoring started, and the information about whether an intermittent error occurs (the path has been removed from those paths subject to automatic failback). Table 2.6 lists whether the above items are reset.

If you want to check whether intermittent error monitoring is being performed for the path, check the IEP item displayed when the dlnkmgr command's `view -path` operation is executed with the `-iem` parameter or the **Intermittent Error Path** item in the Path List view of the HDLM GUI. If a numerical value of 0 or greater is displayed in the **Intermittent Error Path** item, then intermittent error monitoring is being performed.

Table 2.6 When User Operations change Intermittent Error Information

User Operation		Number of Errors and Time Passed since Error Monitoring Started	Information about Paths not Subject to Automatic Failback
Changing the setting for intermittent error monitoring	Setting `off`	Reset	Reset[1]
	Changing the conditions for an intermittent error during intermittent error monitoring	Reset[2]	Inherit
	Setting `on` during intermittent error monitoring by executing the `set` operation (the conditions for the intermittent error monitoring are not changed)		
	Clicking the **Apply** or **OK** button in the window for the Options window of the HDLM GUI.#[3] during intermittent error monitoring		

User Operation		Number of Errors and Time Passed since Error Monitoring Started	Information about Paths not Subject to Automatic Failback
	Changing the setting for intermittent error monitoring to outside the intermittent error monitoring.	(Not applicable) (Not counted.)	Inherit
Changing the automatic failback settings	Setting `off`	Reset	Reset
Changing the path status	Placing the path Offline(C)	Reset	Reset
	Placing the path Online outside the intermittent error monitoring	(Not applicable) (Not counted.)	Reset
	Placing the path Online during intermittent error monitoring	Inherit	(Not applicable)(If a path has been removed from the paths subject to automatic monitoring, that path is not monitored.)
Restarting the HDLM manager		Reset#4	Inherit
Restarting the host		Reset	Reset

[1]When you change the intermittent error monitoring functionality to off, information about paths not subject to automatic failback will be reset. When you change the intermittent error monitoring functionality to off and you do not want to reset information about paths not subject to automatic failback, place the target paths Offline(C).

[2]The number of errors is reset to `0`, and then monitoring restarts in accordance with the changed monitoring conditions.

[3]If the settings for a function other than intermittent error monitoring have been changed or the settings for intermittent error monitoring have not been changed, and then the **Apply** or **OK** button is clicked, the number of error occurrences and the time since monitoring started are reset. To leave the setting unchanged, close the Options window by clicking the **Cancel** button. If you want to change the settings for a function other than intermittent error monitoring but do not want to reset the intermittent error monitoring status, use an HDLM command.

[4]The number of errors is reset to `0`, and then monitoring restarts.

2.9 Detecting Errors Using Path Health Checking

HDLM can check the status of paths at regular intervals, and detect errors. This functionality is called *path health checking*.

Without path health checking, an error is not detected unless I/O is performed because the system only checks the path status when I/O is performed. With path health checking, however, the system checks the status of online paths at regular intervals regardless of whether I/O is performed. If an error is detected in a path, path health checking functionality switches the status of that path to `Offline(E)` or `Online(E)`, so you can use the `dlnkmgr` command's `view` operation or the Path Management window of the HDLM GUI to check the path error.

For example, in a normal state, I/O is not performed on the paths of the standby host in the cluster configuration or on the non-owner paths (that is, some of the paths that access the TagmaStore AMS/WMS series, Thunder 9500V Series, and Thunder 9200 storage system). Because of this, for the standby host or a host connected to non-owner paths, we recommend that you use path health checking to detect errors. This enables the system to use the most recent path-status information when selecting the switching destination.

You can configure path health checking by using the Options window of the HDLM GUI or by executing the `dlnkmgr` command's `set` operation. For details on the Options window, see sections 4.2.8 and 6.3. For details on the `set` operation, see section 7.6.

2.10 Dynamic Reconfiguration

Using the Windows plug-and-play functionality, you can add an LU and a path when the host installing HDLM is running, which is called dynamic reconfiguration functionality. For details on the dynamic reconfiguration, see section 4.6.1.

2.10.1 Adding an LU Dynamically

The LU dynamic addition functionality enables you to add an LU and a path when the host installing HDLM is running.

For details on the LU dynamic addition functionality, see section 4.6.1.

2.10.2 Deleting an LU Dynamically

The LU deletion functionality automatically removes an LU from HDLM management when all the paths to that LU are disconnected.

You can set the LU deletion functionality by specifying the `dlnkmgr` command's `set` operation together with the `-rmlu on` parameter in the HDLM command. You can also set this functionality in the Options window of the HDLM GUI. For details on the `set` operation, see section 7.6. For details on the operation of the **Options** window, see section 6.3.

For details on deleting an LU dynamically, see section 4.6.2.

2.11 Error Management

For troubleshooting, HDLM collects information into log files. The error information can be filtered according to the error level, and collected into the log files.

Figure 2.15 shows the data flow when collecting error information.

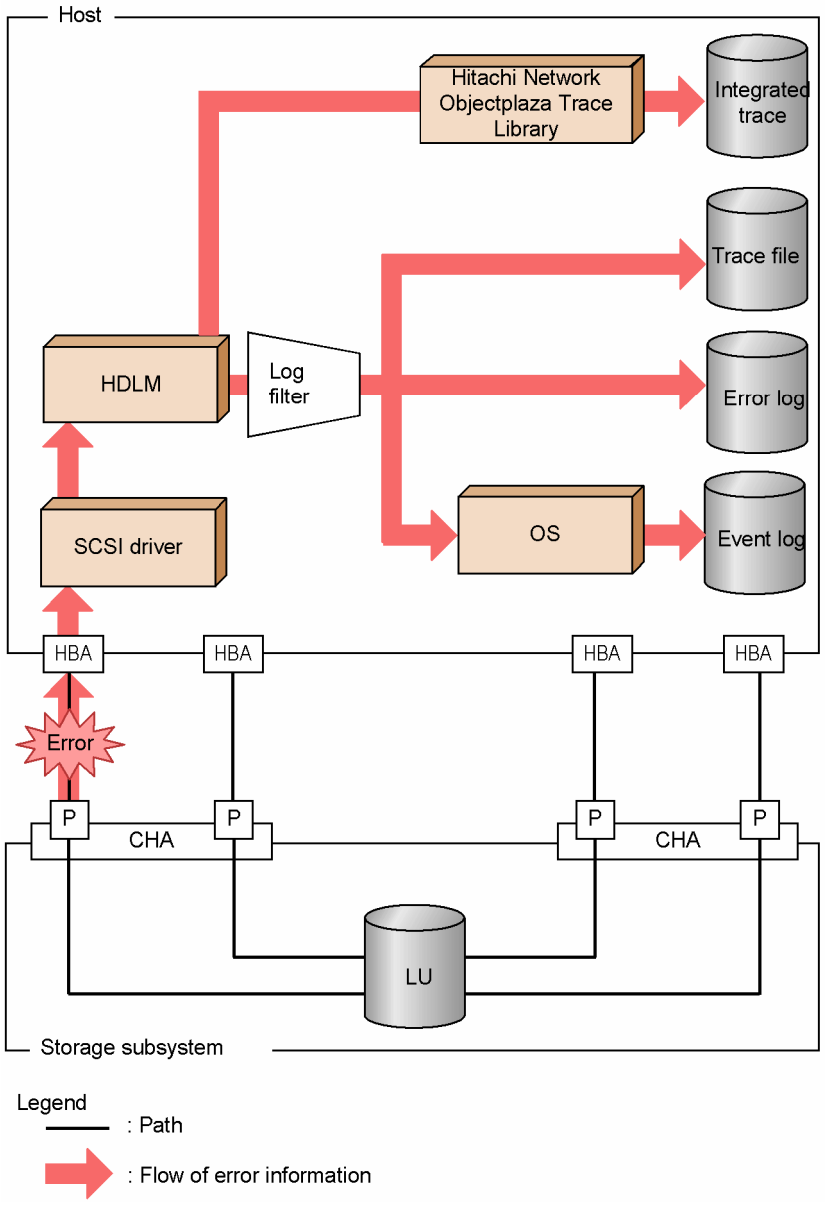


Figure 2.15 Data Flow when Collecting Error Information

Logs might be collected in layers lower than HDLM, such as for the SCSI driver. For details on the logs, see the Windows documentation.

2.11.1 Collected Logs

HDLM collects information on the detected error and trace information in the integrated trace file, trace file, error logs and event logs. You can use the error information to examine the status of an error and analyze the cause of the error.

The information about the Windows system-down is output to a system memory dump file.

A system memory dump file is a file to which the system memory data is output when Windows system-down occurs. This file is required when Windows system-down occurs. Specify the following procedure to output the system memory dump file.

Click **Control Panel**, **System**, **Startup/Shutdown**, **Write Debugging Information is chosen with Recovery**, and then choose **Kernel Memory Dump** or **Complete Memory Dump**.

Table 2.7 describes the types of error information.

Table 2.7 Types of Error Information

Log Name	Description	Output Destination
Integrated trace file	Operation logs of the HDLM command and GUI are collected.	The default file path is *drive-for-program-installation*:\Program Files[1]\HITACHI\HNTRLib2\spool\hntr2*n*.log (*n* indicates a file number) To specify the output destination directory and the file prefix for the integrated trace file, use a utility of Hitachi Network Objectplaza Trace Library (HNTRLib2).
Trace file	Trace information on the HDLM manager is collected for the level set by the user. If an error occurs, you might need to change the settings to collect trace information.	The trace file name is \Program Files\HITACHI\DynamicLinkManager\log\hdlmtr[1-64].log[2]
Error log	Error information for the user-defined level is collected from detected errors. By default, HDLM collects all detected error information.	HDLM Manager logs: \Program Files\HITACHI\DynamicLinkManager\log\dlmmgr[1-16].log[2] HDLM GUI logs: \Program Files\HITACHI\DynamicLinkManager\log\dlmgui[1-2].log[2] HDLM remote access interface logs: \Program Files\HITACHI\DynamicLinkManager\log\dlmwebagent[1-*n*].log[2] The value *n* depends on the setting in the file dlmwebagent.properties.
Event log	Information about very severe errors (severity level is Critical or Error) is collected from detected errors. You can use administrative tools such as Event Viewer to check event logs.	Event log (application log)

[1] In the Windows Server 2003(IPF and x64), replace this part with Program Files (x86).

Log Name	Description	Output Destination
[2]The underlined part indicates the folder specified during installation. When obtaining these files, make sure that you copy them to other files.		

For details on error levels, see section 2.11.2.

Note: To collect logs, HDLM uses the Hitachi Network Objectplaza Trace Library service. If this service is not active, start it as follows: In **Control Panel**, choose **Administrative Tools** and then **Services** to open the Services window. In the list of services, select **Hitachi Network Objectplaza Trace Monitor 2**. Then from the **Action** menu choose **Start**.

2.11.2 Filtering of Error Information

Errors that HDLM detects are classified into error levels. Table 2.8 lists the error levels, in order of adverse effect on the system.

Table 2.8 Error Levels

Error Level	Meaning	Level Shown in Event Viewer
Critical	Fatal errors that may stop the system.	Error
Error	Errors that crucially affect the system. This type of error can be avoided by using failover or other countermeasures.	Error
Warning	Errors that enable the system to continue but, if left, might cause the system to operate improperly.	Warning
Information	Information that indicates the operating history when the system operates normally.	Information

Error information is filtered according to the error level, and then collected.

The error information in error logs and in the event log is collected based on a user-defined collection level. The collection levels are as follows:

Collection levels for error logs and event logs: The event log always collects error information at the Error level or higher.

The error log can use any of the following logging levels to collect error information:

- Collects no error information.
- Collects error information at the Error level and higher.
- Collects error information at the Warning level and higher.
- Collects error information at the Information level and higher (that is, all levels).
- Collects error information at the Information level and higher (including maintenance information).

Collection levels for log information in trace files:

- Outputs no trace information.
- Outputs error information only.
- Outputs trace information on program operation summaries.
- Outputs trace information on program operation details.
- Outputs all trace information.

For details on how to set the collection level, see section 3.5.2.

2.11.3 Collecting Error Information Using the DLMgetras Utility

HDLM has a utility for collecting HDLM error information (`DLMgetras`). By executing this utility, you can simultaneously collect all the information required for analyzing errors: information such as error logs, integrated trace files, trace files, definition files, and the operation system. You can use the collected information when you contact your HDLM vendor or maintenance company (if there is a maintenance contract for HDLM). For details on the `DLMgetras` utility, see section 8.2.

2.12 Cluster Support

HDLM is also available for cluster configurations.

Table 2.9 lists the cluster software supported by HDLM.

Table 2.9 Cluster Software Supported by HDLM

Operating System	Cluster Software	Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V	EMC DMX Series	EMC CX Series*	HP EVA Series*
Windows 2000	MSCS	X	--	--	--
	Oracle 9i RAC version 9.2.0.1.0	X	--	--	--
	Oracle RAC 10g version 10.1.0.2.0	X	--	--	--
Windows Server 2003 (IA32)#	MSCS	X	X	X	X
	VCS 4.1, 4.2, 4.3	X	--	--	--
	Oracle RAC 10g version 10.1.0.2.0, version 10.1.0.3.0, version 10.1.0.4.0	X	--	--	--
Windows Server 2003 (IPF) #	MSCS	X	X	X	X
Windows Server 2003 (x64)	MSCS	X	--	--	--

*Only the following operating systems can manage the EMC DMX series, EMC CX series, and HP EVA series:

- Windows Server 2003 (IA32) SP1 or later
- Windows Server 2003 (IPF) SP1 or later

When load balancing is supported in a cluster configuration, HDLM uses a path of the *active host* to access an LU.

For example, in Figure 2.16, when HDLM uses a path that passes through the path (A) of the active host to access a device within the LU, if the path is placed offline, HDLM switches to a path that passes through the path (B) of the active host to continue processing.

The trigger for switching hosts depends on the cluster software.

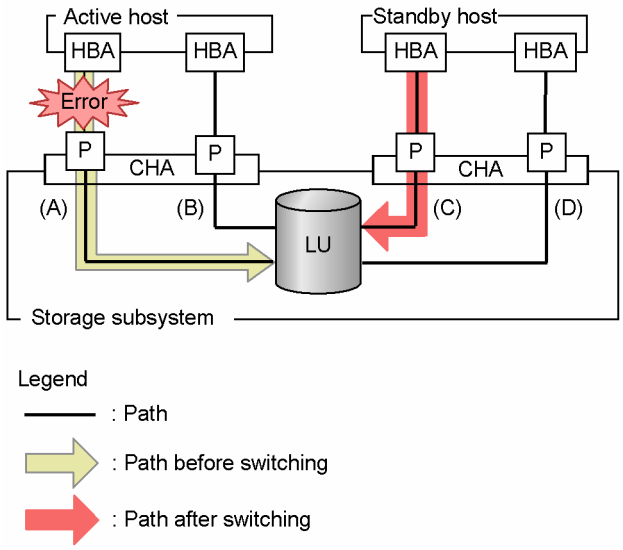


Figure 2.16 Path Switching in a Cluster Configuration

Note

When you use HDLM in a cluster configuration, you must install the same version of HDLM on all the nodes that comprise the cluster. If different versions of HDLM are installed, the cluster system may not operate correctly. If the `HDLM Version` and `Service Pack Version`, which are displayed by executing the following command, are the same, the versions of HDLM are the same:

```
>dlnkmgr view -sys -sfunc
```

The Disk Reservation agent of the VCS is not supported.

When a MSCS environment is created using the Thunder 9200 series or Thunder 9500V, you must perform the storage system settings to enable the persistent reservation functionality. For details, see the list of the storage system setting information in the hardware notes provided with HDLM.

Chapter 3 Creating an HDLM Environment

This chapter explains the procedure for setting up an HDLM environment and canceling environment settings. The chapter is comprised of the following sections:

- System requirements (see section 3.1)
- Flow for creating an HDLM environment (see section 3.2)
- HDLM installation types (see section 3.3)
- Notes on creating an HDLM environment (see section 3.4)
- Setting up HDLM (see section 3.5)
- Installing HDLM (see section 3.6)
- Checking the path configuration (see section 3.7)
- Setting up integrated traces (see section 3.8)
- Uninstalling HDLM (see section 3.9)

3.1 System Requirements

Check the following before installing HDLM:

3.1.1 Applicable Models

3.1.1.1 Applicable Hosts

You can install HDLM on a host that is running an operating system described in Table 3.1.

Table 3.1 Applicable OSs for Hosts

OS	Service Pack
Windows 2000 Server	SP4
Windows Server 2003 (IA32)	No service pack[1]
	SP1
	SP2
Windows Server 2003 (IA32) R2	No service pack
	SP2
Windows Server 2003 (IPF)	No service pack[1]
	SP1
	SP2
Windows Server 2003 (x64)	No service pack
	SP2
Windows Server 2003 (x64) R2	No service pack
	SP2

[1] To use the Storport Miniport driver as an HBA driver in an environment where SP1 or later is not applied, the QFE update program 838894 provided by Microsoft is required.

3.1.1.2 Applicable Host Bus Adapters (HBAs)

For details about the applicable host bus adapters (HBAs), see HDLM *Release Notes*.

3.1.1.3 Applicable Storage Systems

HDLM is applicable to the storage systems described in Table 3.2. Dual controller configuration is required for the applicable storage systems. If a host is used in a HUB connection environment, set unique loop IDs for all the connected hosts and storage systems. For details about the micro-program versions and storage system settings required for using HDLM, see HDLM *Release Notes*.

Table 3.2 Applicable Storage Systems

Applicable Storage Systems[1]	Interface	Operating System			
		Windows 2000 Server	Windows Server 2003		
			IA32	IPF	x64
EMC DMX series[2]	FC I/F	--	Y[3]	Y[3]	--
EMC CX series[4]	FC I/F	--	Y[3]	Y[3]	--
Hitachi Universal Storage Platform V	FC I/F	Y	Y	Y	Y
HP EVA series[6]	FC I/F	--	Y[3]	Y[3]	--
Lightning 9900 Series	FC I/F	Y	Y	Y	Y
Lightning 9900V Series	FC I/F	Y	Y	Y	Y
	iSCSI I/F	--	Y	--	--
SVS/XP10000/XP12000/XP24000	FC I/F	Y	Y	Y	Y
TagmaStore AMS/WMS Series	FC I/F	Y	Y	Y	Y
	iSCSI I/F	--	Y	--	--
TagmaStore Universal Storage Platform 100/600/1100, TagmaStore NSC 55	FC I/F	Y	Y	Y	Y
	iSCSI I/F	--	Y	--	--
Thunder 9200 Series[5]	FC I/F	Y	Y	Y	Y
Thunder 9500V Series	FC I/F	Y	Y	Y	Y
XP128/XP1024	FC I/F	Y	Y	Y	Y

Legend:

Y: Usable

--: Not usable

[1]Dual controller configuration is required.

[2]The evaluation of EMC DMX3000 is completed. A condition of the support is that the response of inquiries for other systems of the EMC DMX series must be the same as that of the EMC DMX3000. When using systems of the EMC DMX series other than the EMC DMX3000, evaluate the connection in advance.

[3]SP1 or later must be installed.

[4]The evaluation of EMC CX700 is completed. A condition of the support is that the response of inquiries for other systems of the EMC CX series must be the same as that of the EMC CX700. When using systems of the EMC CX series other than the EMC CX700, evaluate the connection in advance.

[5]SCSI I/F is not supported.

[6]The evaluation of HP EVA8000 is completed. A condition of the support is that the response of inquiries for other systems of the HP EVA series must be the same as that of the HP EVA8000. When using systems of the HP EVA series other than the HP EVA8000, evaluate the connection in advance.

3.1.2 Microsoft MPIO Drivers

Table 3.3 lists and describes versions of the Microsoft MPIO driver bundled with HDLM.

Table 3.3 Versions of Microsoft MPIO Driver Bundled with HDLM

Driver	Description	File version
mpdev.sys	Multipath Scsi Device Filter	1.17.3790.1759
mpio.sys	Multipath Support Bus-Driver	1.17.3790.1759
mpspfltr.sys	Multipath Scsi Filter	1.17.3790.1759

3.1.3 Related Programs

This section describes the programs related to HDLM.

3.1.3.1 When Setting up a Cluster Configuration

For details about the related programs when setting a cluster configuration, see 2.12.

3.1.3.2 When Using a Volume Manager

Table 3.4 lists and describes the related programs when using a volume manager.

Table 3.4 Related Programs when a Volume Manager is Used

Operating System	Related Programs
Windows 2000 Server	Veritas Volume Manager 3.0
	Veritas Storage Foundation 4.1 for Windows
Windows Server 2003 (IA32)#	Veritas Storage Foundation 4.0 for Windows
	Veritas Storage Foundation 4.1 for Windows
	Veritas Storage Foundation 4.2 for Windows
	Veritas Storage Foundation 4.3 for Windows

#: EMC DMX Series, EMC CX Series and HP EVA Series do not support volume manager.

3.1.3.3 Exchanging Data Using Intermediate Volumes Managed by Hitachi RapidXchange

Table 3.5 lists related programs when exchanging data by using intermediate volumes managed by Hitachi RapidXchange. For details about Hitachi RapidXchange, see the manual *Reference Manual / File Conversion Utility & File Access Library*.

Table 3.5 Related Programs when Exchanging Data by Using Intermediate Volumes Managed by Hitachi RapidXchange

Operating System	Related programs
Windows 2000 Server[1]	File Access Library and File Conversion Utility (FAL/FCU) 1.2-57/20 or later[2]
Windows Server 2003 (IA32)[1]	File Access Library and File Conversion Utility (FAL/FCU) 1.2-57/20 or later[2] 1.3-64/21 or later[3] 1.4-64/21 or later[4]
[1] For details, see section 3.1.1.1. [2]Connection mainframe: MVS Connection storage system: Lightning 9900 Series [3]Connection mainframe: MVS Connection storage system: Lightning 9900V Series [4]Connection mainframe: MVS Connection storage system: TagmaStore USP	

3.1.3.4 Using the HDLM GUI

When using the HDLM GUI, the related program is Microsoft Internet Explorer 5.0 or later.

3.1.4 Memory and Disk Space Requirements

This section describes memory and disk space requirements.

3.1.4.1 Memory Requirements

Table 3.6 lists the memory requirements for a host.

Table 3.6 Memory Requirements for a Host

HDLM GUI	Operating System	Required Memory
Not used	Windows	40MB
Used	Windows	65MB

3.1.4.2 Disk Requirements

This section describes disk space requirements for a host.

Table 3.7 lists the disk space requirements for a host.

Table 3.7 Disk Space Requirements for a Host

Folder	Disk Space Requirements
HDLM-installation-folder	■ When you do not use the HDLM GUI: 110MB + pMB[1] + qMB[2] + 1MB ■ When you do use the HDLM GUI: 110MB + 20MB + pMB[1] + qMB[2] + 1MB
[1]This size depends on the settings for the log files. The maximum size is 30000MB. When s is the error log file size (the default value is 9900) and m is the number of error log files (the default value is 2), this value (p) can be calculated as follows: p = (s x m) / 1024 (rounded-up integer) (units: MB) [2]This size depends on the setting for the trace files. The maximum size is 1000MB. When t is the trace file size (the default value is 1000) and n is the number of trace files (the default value is 4), this value (q) can be calculated as follows: q = (t x n) / 1024 (rounded-up integer) (units: MB)	

3.1.5 Number of Paths Guaranteed in HDLM

Table 3.8 lists the number of LUs, number of paths per LU, and total number of paths guaranteed in HDLM.

Table 3.8 Number of Paths Guaranteed in HDLM

Item	Maximum Value
Number of LUs	256
Number of paths per LU	12
Total number of paths	3,060

3.2 Flow for Creating an HDLM Environment

Set up the environment to use HDLM as follows.

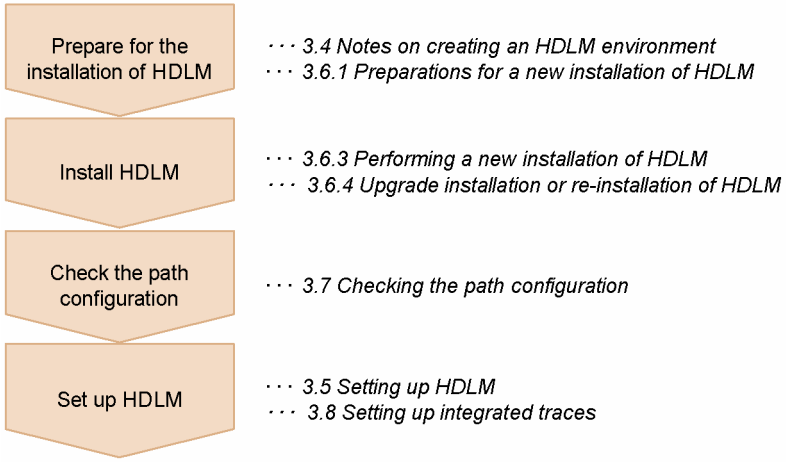


Figure 3.1 Flow of HDLM Environment Setup

3.3 HDLM Installation Types

This subsection describes the following types of HDLM installation: new installation, upgrade installation, and re-installation.

New installation of HDLM:

Installing HDLM in a server on which HDLM has not been installed is called a *new installation of HDLM*.

Upgrade installation of HDLM:

Installing a newer version than the existing version without uninstalling the existing version is called an *upgrade installation of HDLM*. You can perform upgrade installation only for HDLM 5.5 or later.

Re-installation of HDLM:

Installing the same version of HDLM, to restore the existing version, without first uninstalling that version is called a *re-installation of HDLM*.

3.4 Notes on Creating an HDLM Environment

When you are building an HDLM environment, note the points listed below.

3.4.1 Notes on HBAs and HBA Drivers

- When using the Storport Miniport driver as an HBA driver in Windows Server 2003, install QFE 838894 or later for the Microsoft Storport driver install or Windows Server 2003 SP1 or later, before installing HDLM. If you have installed HDLM in an environment where either QFE 838894 or later or Windows Server 2003 SP1 or later was not installed, the following problems might occur:
  - When HDLM is installed in an environment where the boot disk is an HDLM management-target disk, Windows Server 2003 will not be able to start. If this happens, you must reinstall Windows Server 2003.
  - When HDLM is uninstalled, LUs managed by HDLM will no longer be available after the system is restarted. If this happens, perform the following procedure:
    1. Stop applications that access the LUs managed by HDLM.
    2. In the Device Manager window, in the **View** menu choose **Devices by type**.
    3. Double-click **Disk Drives** to display a list of disk drives.
    4. In the list, select the disk drive for the LUs managed by HDLM, and then choose **Action** and **Properties**.
    5. Click the **Driver** tab
    6. Click the **Driver Details** button.

       The **Driver File Details** window is displayed.
    7. If the driver file is `mpdev.sys`, click the **Delete** button to delete the device from the system.
    8. Perform steps 5 through 7 for all the disk drives of LUs managed by HDLM.
    9. Choose **Action** and then **Scan for hardware changes**.
    10. In the Disk Management window, click **Rescan Disks**.
- Note the following if you use a QLogic HBA driver version earlier than 8.2.3.11 and change the configuration to a multipath configuration after HDLM installation: If all paths are connected to a single CHA of the storage system and an error occurred in the connected CHA, all the paths will also fail. This might slow the path failover. Make sure that you connect the paths to multiple CHAs.
- When you use multiple HBAs, make sure that the models of the HBAs are the same. Also make sure that the HBA firmware versions and host driver versions are the same.

3.4.2 Notes on Storage Systems

- You must not change the vendor ID and product ID of the storage system. If you change these IDs, HDLM cannot recognize the storage system.

- For a configuration in which the host and the storage system are connected by using a Fibre Channel switch, select *Point To Point* as the connection type. If you select *FC-AL* (Fibre Channel Arbitrated Loop) as the connection type, an unexpected path error may be detected.
- Windows can recognize LUNs from 0 to 255. Therefore, set LUNs in the range from 0 to 255 in the storage system management software.

3.4.3 Notes on HDLM Versions

- If HDLM 5.4 or earlier has been installed, uninstall HDLM first and then proceed with the new HDLM installation in accordance with the procedure described in section 3.6.5.
- In HDLM 5.6 or later, trace files for HDLM versions earlier than 5.6 are divided into integrated trace files and trace files. The logs for the HDLM command and HDLM GUI operations are output to integrated trace files. Trace information for an HDLM manager is output to trace files. The output destinations for the files change as follows:
  - When you migrate from an HDLM version earlier than 4.0 to an HDLM version 5.6 or later

    - Trace files before migration:*drive-for-program-installation*:\Program Files[#]\HITACHI\HNTRLib\spool\hntr*n*.log (*n* indicates a file number)

    - Integrated trace files after migration: *drive-for-program-installa*tion:\Program Files#\HITACHI\HNTRLib2\spool\hntr2n.log (*n* indicates a file number)

    - Trace files after migration: *drive-for-program-installation*:\Program Files\HITACHI\DynamicLinkManager\log\hdlmtrn.log (*n* indicates a file number)

      The underlined part indicates the folder specified during installation.
  - When you migrate from HDLM version 4.1 - 5.5 to HDLM version 5.6 or later, or when you perform an upgrade installation from HDLM 5.5 or later

    - Trace files before migration or upgrade: *drive-for-program-installation*:\Program Files#\HITACHI\HNTRLib\spool\hntr*n*.log (*n* indicates a file number)

    - Integrated trace files after migration or upgrade:*drive-for-program-installation*:\Program Files#\HITACHI\HNTRLib2\spool\hntr2*n*.log (*n* indicates a file number)

    #

    In Windows Server 2003(IPF and x64), replace this part with Program Files (x86).

    - Trace files after migration or upgrade: *drive-for-program-installation*:\Program Files\HITACHI\DynamicLinkManager\log\hdlmtrn.log (*n* indicates a file number)

      The underlined part indicates the folder specified during installation.

- Before installing or upgrading HDLM 5.5 or later, make sure that no other application is using an HDLM management-target LU.
- When HDLM 5.5 or later is installed for the first time, the event described below occurs and is output to the event log. However, it does not affect the system or HDLM operations.

```
Description
Event provider attempted to register query "select * from WMIEvent" whose target class
"WMIEvent" does not exist. The query will be ignored.
```

- When you use HDLM in a cluster configuration, you must install the same version of HDLM on all the nodes that comprise the cluster. If different versions of HDLM are installed, the cluster system may not operate correctly. If the `HDLM Version` and `Service Pack Version`, which are displayed by executing the following command, are the same, the versions of HDLM are the same:

```
>dlnkmgr view -sys -sfunc
```

3.4.4 Notes on Windows

- Before upgrading the OS from Windows 2000 Server to Windows Server 2003 or re-installing the OS during system recovery, always uninstall HDLM. After upgrading the OS, install the appropriate HDLM version for the upgraded operating system.
- We recommend you install the operating system and HDLM on an internal disk of the host. If you install them on an HDLM management-target disk, the following problems might occur.
  - You might not be able to store the operating system crash-dump and error information on the disk.
  - After uninstalling HDLM, files might not be deleted.
- If the size of the `Path` system environment variable is 1024 bytes or more, HDLM Manager might not be able to start. When HDLM Manager fails to start, the following message is output to the Windows event log (system):

```
Source: Service Control Manager
Type: Error
Event ID: 7000
Description: DLMManager service could not be started for the following reason: The
service did not respond to the start request or control request within the specified
period.
```

  If HDLM Manager fails to start, delete unnecessary character strings in the path so that the size of the `Path` system environment variable is 1024 bytes or less:

  For Windows Server 2003 (IPF) and Windows Server 2003 (x64):

  Windows-installation-drive:\Program Files (x86)\Common Files\Hitachi

  HDLM-installation-folder\bin

  HDLM-installation-folder\lib

  For Windows versions other than the above:

  Windows-installation-drive:\Program Files\Common Files\Hitachi

  HDLM-installation-folder\bin

HDLM-installation-folder\lib

For Windows Server 2003 SP1 and Windows Server 2003 R2 (no service pack), if you do not want to use one of the above methods, you can use a Microsoft hotfix to start HDLM Manager.For details about how to obtain and use the hotfix and how it affects the system, contact Microsoft.

- Before installing HDLM, enable the setting for automatically shortening file and folder names (8.3 format). If this setting is disabled, shortened names might not be generated in the `Intel 32` folder in which the HDLM uninstallation program is stored, and uninstallation of HDLM cannot be performed because the uninstallation program cannot be started. If shortened names are not generated in the `Intel 32` folder, uninstall HDLM according to the procedure described in 3.9.2.
- HDLM uses the Windows Installer service during installation. Therefore, when you install HDLM, take the following measures:
  - In the Startup Type setting for the Windows Installer service, specify Manual or Automatic.
  - Before installing HDLM, make sure that other programs are not using the Windows Installer service.

  If you install HDLM while the **Startup Type** setting for the Windows Installer service is disabled or while another program is using HDLM, the following message appears and installation might fail:

  `KAPL09034-E An Internal error occurred in the HDLM Installer. Code = -99 nnnnn`

  If this message appears during a new installation of HDLM:

  Confirm that conditions 1 and 2 above are met, and install HDLM again.

  If this message appears during an upgrade or re-installation of HDLM:

  Confirm that conditions 1 and 2 above are met, and then reperform an upgrade or re-installation of HDLM.

  You must be careful because even though an upgrade or re-installation of HDLM has actually failed, the Add/Remove Programs window might indicate that HDLM has been installed normally.
- If you install HDLM when either of the following conditions exists, an error might be displayed for the mirror disk in the Disk Management window of Windows.
  - A mirror disk volume that uses a Windows dynamic disk exists among the HDLM management-target devices.
  - An application that uses the dmaadmin service is being executed.

  This error does not affect the data of the HDLM management-target devices. If you restart the host and then activate the disk in the Disk Management window of Windows, this error will not appear. To prevent the error from occurring, perform the following before installing HDLM:
  - When a mirror disk volume that uses a dynamic disk exists among the HDLM management-target devices.

    Close the management console for the disk.
  - When the application that uses the dmaadmin service is being executed.

    Stop the application that uses the dmaadmin service.

- In Windows Server 2003 (x64), do not create the data stored in the GUID Partition Table (GPT).
- When installing HDLM, The name of the HDLM installation folder and the names of all its parent folders must fulfill all of the following conditions:
  - The name must not be a reserved name specified in the operating system.

    Reserved names specified in the operating system include, for example, `CON`, `AUX`, `COM1` to `COM9`, `LPT1` to `LPT9`, `PRN`, and `NUL`.
  - The name must contain the following characters only:

    `A - Z`, `a - z`, `0 - 9`, `-`, `_`, `.`, `@`, or a single byte space
  - The end of the name cannot be a single byte space.
  - The name cannot contain two or more single byte spaces consecutively.

  If you attempt to install the HDLM in a folder that does not fulfill these conditions, problems such as those described in Table 3.9 might occur. In such a case, reinstall the HDLM according to the procedures given below.

Table 3.9 Error Log Collection Level Setting Values

Problem	Action
An internal error occurred and the installation was interrupted.	Specify a folder that fulfills the above conditions and reinstall the HDLM.
After the installation finished, error information could not be collected when you executed the `DLMgetras` utility for collecting HDLM error information.	Uninstall the HDLM and then install it again specifying a folder that fulfills the above conditions.

3.4.5 Notes on Related Software

- If HDLM is installed on a host in which the MPIO driver has already been installed, the MPIO driver that is bundled with the HDLM CD-ROM overwrites the existing MPIO driver. The MPIO driver consists of the `mpio.sys`, `mpspfltr.sys`, and `mpdev.sys` files.
- Do not install any multi-path management software other than HDLM. If multi-path management software other than HDLM has been installed on the host, uninstall the software, and then restart the host before re-installing HDLM.
- If you perform an upgrade installation or re-installation of HDLM, a message might appear, asking you to confirm whether you want to overwrite the MPIO driver. If this message appears, stop the installation, make sure that no other multi-path management software is installed, and then retry the installation.
- If you use HDLM with Oracle RAC 10g and the following conditions are satisfied, you must change the settings for Oracle RAC 10g after building the environment.
  - Release of 10.1.0.3.0 or later of Oracle RAC 10g is being used.
  - A host and a voting disk are connected by multiple paths (in a multi-path configuration) in an FC-SAN environment.

In the above configuration, we recommend that you change MISSCOUNT, which is the I/O timeout threshold value for a voting disk, to the following value: (*greatest-number-of-paths-connected-to-the-voting-disk* x 60 seconds).

If an I/O timeout occurs between a host and a voting disk in the above conditions, Oracle RAC 10g might regard it as the I/O timeout before the HDLM failover function checks all the paths. In this case, Oracle RAC 10g determines that an error has occurred in a node, and re-configures the cluster after node down. For details on how to change MISSCOUNT, contact the company with which you have a contract for Oracle Support Services. Note that when you uninstall HDLM from the above configuration, you must reset the value for MISSCOUNT to the original value. Therefore, we recommend that you make a note of the original value for MISSCOUNT before changing it.

- If you install HDLM while resident software such as an antivirus program is running, HDLM might not operate correctly. Before installing HDLM, make sure that you have stopped any resident software programs.

3.4.6 Notes on New Installations and Upgrade Installations

- When installing HDLM, use only one cable to connect the host and the storage system until instructed otherwise in the procedure in section 3.6.2. If the host is restarted when the host and the storage system are connected using multiple paths (multi-path configuration) at a time other than that indicated in the procedure in section 3.6.2, the contents of the disk might become invalid.
- HDLM does not support configurations in which the same host can use both a FC-SAN and an IP-SAN.
- If you install HDLM for the first time, or perform an upgrade installation of HDLM after the license has expired, a license key is necessary. To update the HDLM license, execute the dlnkmgr command's set -lic operation. The expiration time of the license key is determined by the license key specified in the license key file or the input license key type. For information on license key types and the set operation, see section 7.6.
- Installing HDLM requires 70 MB of free space on the system drive (for the temporary file).
- Terminate all running programs before installing HDLM.
- If you selected an installation folder for HDLM, and then selected another folder, a folder other than the last selected folder might be created. Delete the created folder because a folder other than the last selected folder is not necessary.
- Depending on the environment, installing HDLM might take some time to finish. Do not terminate the installation process while a progress bar for installation is displayed. The following is an approximate calculation of the time required for installation:

  (5 x *number-of-connected paths*) seconds

- If installation of HDLM terminates abnormally and a KAPL09016-E message is output, check whether an HDLM version from another operating system has been installed on the same drive.
  - When an HDLM version from another operating system has been installed:

    Uninstall the installed HDLM, and then rerun the installation program.

- When HDLM for another operating system has not been installed:
  a. Perform the installation again according to the following procedure:

     In **Explorer**, in the **Tools** menu choose **Folder Options**.

     The **Folder Options** window is displayed.

  b. Click the **View** tab, and in the **Advanced settings** field, under **Hidden files and folders,** select **Show hidden files and folders**.

  c. Delete the following folders:

     operating system-installation-drive:\Program Files\InstallShield \InstallationInformation\{DFF378A1-240E-11D5-8A43-0000E2382F13}

  d. Restore the setting for **Show hidden files and folders** that you changed in step 2.

  e. Rerun the HDLM installation program.

- When installing HDLM on a host where a Device Manager Agent 5.0 or later is installed, do not execute any of the following commands of Device Manager Agent during installation:

  `hbsasrv`, `HiScan`, `hdvmagt_account`, `hdvmagt_schedule`, `hldutil`, `TIC`

3.4.7 Notes on Upgrade Installation

If either of the following conditions is met, the disk numbers managed by Windows might be changed from the state they were in prior to migration or upgrade installation:

- When disk numbers managed by Windows are not consecutive, HDLM versions earlier than 5.4 are migrated to 5.9.1
- When Hitachi's RAID Manager command device is used, HDLM versions earlier than 5.7 are migrated to 5.9.1 or an upgrade installation is performed

If a disk number is changed and the disk is being used by an application, perform the following:

If the disk number of the disk being used by an application can be changed:

Change the disk number to the number that will be used after the change.

If the disk number of the disk being used by an application cannot be changed:

Restore the disk number managed by Windows to the number that was in use prior to the migration or upgrade installation. For details about how to do this, contact Microsoft.

3.5 Setting up HDLM

HDLM has load balancing, automatic failback, error logging, and other functions. You can set up these functions by using the Options window of the HDLM GUI or by using the `dlnkmgr` command's `set` operation. The following subsections describe these setup methods.

3.5.1 Preparations for Setting HDLM Functionality

For setting the HDLM functionality, this chapter describes steps involved in starting the Options window of HDLM and how to check the settings before the change by using the `dlnkmgr` command's `set` operation.

3.5.1.1 Opening the Options Window Using the HDLM GUI

When you set the HDLM functionality by using the HDLM GUI, start the Path Management window and then the Options window in accordance with the following procedure.

To open the Options window:

1. Log on to Windows as a member of the administrators group.

   The Path Management window cannot be displayed if you logged on to Windows as a user other than a member of the administrators group.

2. From the **Start** menu, select **Programs**, **Dynamic Link Manager**, and then **HDLM GUI**. The **Path List** view of the Path Management window is displayed.

3. Click the **Options** button. As shown in Figure 3.2, the Options window opens with the Options window displayed.

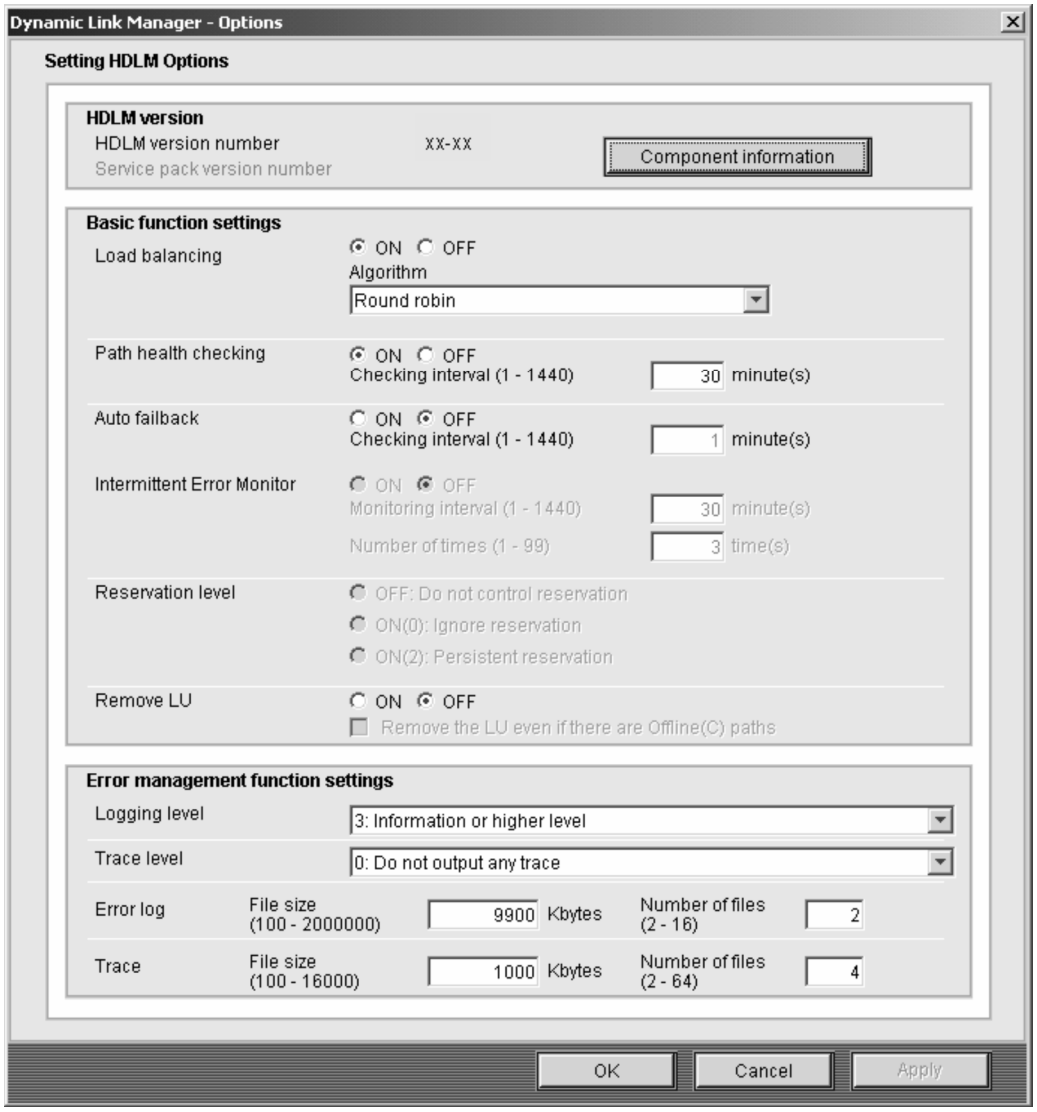


Figure 3.2 Options Window

3.5.1.2 Checking Current Settings Using the dlnkmgr Command

Check the current settings by executing the following command to set the HDLM functionality by using the `dlnkmgr` command's `set` operation.

```
>dlnkmgr view -sys -sfunc
HDLM Version                  : xx-xx
Service Pack Version          :
Load Balance                  : on(rr)
Support Cluster               : off
Elog Level                    : 3
Elog File Size(KB)            : 9900
Number Of Elog Files          : 2
Trace Level                   : 0
Trace File Size(KB)           : 1000
Number Of Trace Files         : 4
Path Health Checking          : on(30)
Auto Failback                 : off
Remove LU                     : off
Intermittent Error Monitor    : off
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

3.5.2 Setting HDLM Functionality

The recommended and default values for the HDLM functionalities are shown below in Table 3.10.

Table 3.10 Recommended and Default Values for Each Function

Functionality	Default Value	Recommended Value
Load-balancing	ON Algorithm is round robin	ON The recommended algorithm depends on the operating environment.
Path health checking	ON 30-minute check interval	ON The recommended checking interval depends on the operating environment.
Automatic failback	OFF	OFF
Intermittent Error Monitor	OFF	OFF
Remove LU	OFF	The recommended value depends on the operating environment.
Logging level	3: Collect all information for errors with the level "Information" or higher	3: Collect all information for errors with the level "Information" or higher
Trace level	0: Do not output a trace	0: Do not output a trace
File size (for Error log)	9900 (KB)	9900 (KB)
Number of files (for Error log)	2	2
File size (for Trace)	1000 (KB)	1000 (KB)
Number of files (for Trace)	4	4
For the `dlnkmgr` command's `set` operation, enter lower-case characters such as on and `off`, instead of `ON` and `OFF`, as shown in the table.		

3.5.2.1 Setting Load Balancing

You can select whether to enable load balancing. In a cluster environment, the load balancing function is only available for TagmaStore, Thunder 9200/9500V Series, and Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V. In a non-cluster environment, the load balancing function is available for TagmaStore, Thunder 9200/9500V Series, Lightning 9900/9900V Series, Universal Storage Platform V, and the EMC DMX series. The above-mentioned conditions are applied regardless of the settings for the EMC DMX series, EMC CX series, and HP EVA series. For example, in a cluster environment, the load balancing function is disabled even if it is set to be enabled for the EMC DMX series. For details on the cluster software supported by HDLM, see section 2.12.

- Setting by using the Options window

  Set it **ON** to enable load balancing. Otherwise, set it to **OFF**. After selecting **ON**, select a desired **algorithm** to be used for load balancing from the pull-down list.

- Setting by using the `set` operation, the following is an example of a command to set load balancing.

```
>dlnkmgr set -lb on -lbtype rr
```

  Set load balancing to `on` to enable load balancing. Otherwise, set it to `off`. When you set this value to `on`, specify `rr` for round robin or `exrr` for extended round robin after the `-lbtype` option. The type of algorithm specified by the `-lbtype` parameter remains stored in the system, even when you disable the load balancing function by specifying `-lb off`. Therefore, when you re-enable load balancing without specifying an algorithm, load balancing will be executed according to the settings stored in the system.

3.5.2.2 Setting Path Health Checking

You can select whether to enable path health checking.

- Setting by using the Options window.

  Set it to **ON** to enable path health checking. Otherwise, set it to **OFF**. When selecting **ON**, you can specify **Checking interval** for path health checking.

- Setting by using the `set` operation.

  The following is an example command to set path health checking.

```
>dlnkmgr set -pchk on -intvl 10
```

  To enable path health checking, set it to `on`. Otherwise, set it to `off`. When you set this value to `on`, you can use the `-intvl` parameter to specify the *checking* interval. The value that was specified previously will be applied if the *checking* interval is not specified. For example, specify the path health check as `off` after specifying the *checking* interval as `15` minutes and executing. Then, when executing after specifying the path health check as `on` without specifying the *checking* interval, the `15` minutes that were specified previously will be applied again.

3.5.2.3 Setting Automatic Failback

You can select whether to enable automatic failback.

When intermittent error monitoring is enabled and the number of error occurrence is `2` or more, the following condition must be satisfied:

error-monitoring-interval >= *checking-interval-for-automatic-failback* x *number-of-times-error-is-to-occur-during-intermittent-error-monitoring*

If this condition is not satisfied, an error occurs and the warning message (KAPL02064-W for the Options window and KAPL01080-W for the `set` operation) is output.

In such a case, change any of the following settings: the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to `1`, the condition above does not need to be satisfied.

- Setting Automatic Failback using the Options window

  To enable automatic failback, set it to **ON**. Otherwise, set it to **OFF**. When you specify **ON**, you can select the **checking interval** for automatic failback.

- Setting Automatic Failback using the set Operation

  The following shows an example of executing the command to set automatic failback:

  ```
  >dlnkmgr set -afb on -intvl 10
  ```

  To enable automatic failback, set it to `on` . Otherwise, set it to `off`. The *checking* interval can be specified with the `-intvl` parameter when `on` is specified. The value that was specified previously will be applied if the *checking* interval is not specified. For example, specify auto failback as `off` after specifying the *checking* interval to five minutes and executing. Then, when executing after specifying auto failback as `on` without specifying the *checking* interval, the five minutes that were specified previously will be applied again.

3.5.2.4 Settings for Intermittent Error Monitoring

Intermittent error monitoring is specifiable only when automatic failback is enabled. To prevent an intermittent error from reducing I/O performance, we recommend that you monitor intermittent errors when automatic failback is enabled.

When intermittent error monitoring is enabled, you can specify intermittent error conditions (the conditions used by the system to determine whether an intermittent error is occurring). The default value for the intermittent error monitoring interval is 30. The default value for the number of error occurrences is 3.

The system assumes that an intermittent error is occurring if the specified number of times that the error is to occur is reached during the monitoring interval (from the time that the monitoring interval starts, until the specified interval ends). A path that is assumed to have an intermittent error is excluded from automatic failback. Intermittent error monitoring starts when the path is recovered from the error by using automatic failback. Monitoring is performed on individual paths.

When a value of 2 or more is specified in number of times, make sure that the condition shown in section 3.5.2.3 is satisfied.

To determine whether a path is ineligible for automatic failback, you can use the results of the `dlnkmgr` command's `view` operation or the **Path List** view of the HDLM GUI.

- Setting by using the Options window.

  To enable intermittent error monitoring, specify **ON**. To disable intermittent error monitoring, specify **OFF**. When you specify **ON**, you can specify intermittent error conditions (the conditions used by the system to determine whether an intermittent error is occurring) in **Monitoring interval** and **Number of times**.

- Setting by using the `set` operation.

  The following shows an example of executing the command to set the error log collection level.

  ```
  >dlnkmgr set -iem on -intvl 20 -iemnum 2
  ```

  `on` specifies that intermittent error monitoring is to be used. To disable intermittent error monitoring, specify `off`. When you set this parameter to `on`, you can specify intermittent error conditions (the conditions used by the system to determine whether an intermittent error is occurring) by using the `-intvl` and `-iemnum` parameters. Specify the monitoring interval for an intermittent error in the `-intvl` parameter, and the number of times that the error is to occur in the `-iemnum` parameter. When these parameters are omitted and 3 or more errors occur within 30 minutes, the system assumes that an intermittent error is occurring.

3.5.2.5 Setting the Reservation Level

You cannot set the reservation level (reservation control method for the LU).

3.5.2.6 Setting the LU Deletion Functionality

You can select whether to enable the LU dynamic removal function.

For details on the LU deletion functionality, see section 4.6.2.

Table 3.11 shows the values for the LU deletion functionality.

Table 3.11 LU Deletion Function Values

Values in Options Window		Values in Set Operation	Description
OFF		`off`	The LU is not removed from HDLM-management even if the error occurs in all the paths to the LU, all the paths to the LU are disconnected, or the LU is deleted. The status of the paths is Offline(E) and Online(E). This operation is as equal as the operation in HDLM 5.1 or earlier. The off option is recommended when you want to use the same functionality as you use in HDLM 5.1 or earlier, without using the LU deletion functionality.
ON	The **Remove the LU even if there are Offline(C) paths** option is set to OFF.	`on`	The LU is removed from HDLM-management when all the paths to the LU are disconnected. However, if an Offline(C) path is included in the disconnected paths, the LU is not deleted from HDLM-management. The deleted LU is restored when it is recovered from the physical failure and the disk is re-scanned.
	The **Remove the LU even if there are Offline(C) paths** option is set to ON.	`on -force`	The LU is removed from HDLM management when all the paths to the LU are disconnected, even when an Offline(C) path is included. The removed LU is restored when it is recovered from the physical failure and the disk is re-scanned.

- Setting the LU Deletion Functionality using Options window

  When using the Remove LU functionality, set it to **ON**. When not using the Remove LU functionality, set it to **OFF**. If you select **ON**, you can specify the conditions for LU dynamic removal in **Remove the LU even if there are Offline(C) paths**.

- Setting the LU Deletion Functionality Using the set Operation

  The following is an example of setting the LU deletion functionality using the `set` operation:

  ```
  >dlnkmgr set -rmlu on -force
  ```

  To enable the LU deletion functionality, specify `on`. To disable the LU deletion functionality, specify `off`. If you specify `on`, you can set the conditions for by using the `-force` parameter for LU dynamic removal.

3.5.2.7 Setting Error Log Collection Level

The error log collection level can be set.

There are two error logs: the HDLM manager log file `dlmmgr`*n*`.log` (*n* indicates a file number from `1` to `16`) and the HDLM GUI log file `dlmgui`*n*`.log` (*n* indicates a file number of `1` or `2`).

Table 3.12 lists and describes values for the error log collection level setting.

Table 3.12 Error Log Collection Level Setting Values

Value*	Description
0: Do not collect an error log	No error logs are collected.
1: Error or higher level	All information for errors with the level "Error" or higher is collected.
2: Warning or higher level	All information for errors with the level "Warning" or higher is collected.
3: Information or higher level	All information for errors with the level "Information" or higher is collected.
4: Information or higher level (including maintenance information)	All information for errors with the level "Information" or higher (including maintenance information) is collected.
* For the `dlnkmgr` command's `set` operation, specify a number such as `0` or `1`.	

If an error occurs, you might have to change the collection level to 1 or higher to collect log information.

The higher this value is set, the more log information will be output. When the output log is large, it takes less time to overwrite the old error log information with the new information.

- Setting by using the Options window

  Select **Logging level** from the pull-down list box.

- Setting by using the `set` operation

  The following shows an example of executing the command to set the error log collection level.

  ```
  >dlnkmgr set -ellv 2
  ```

  Specify the error log collection level in a number.

3.5.2.8 Setting the Trace Level

The trace output level can be set.

A trace file in which a trace level can be set is `hdlmtrn.log` (*n* indicates a file number from `1` to `64`).

Table 3.13 lists and describes values for the trace level setting.

Table 3.13 Trace Level Setting Values

Value*	Description
0: Do not output any trace	No trace is output.
1: Error information only	Only error information is output.
2: Summary of program operation	Program operation summaries are output.
3: Details of program operation	Program operation details are output.
4: All information	All information is output.
*For the `dlnkmgr` command's `set` operation, specify a number such as `0` or `1`.	

If an error occurs, you may have to set the trace level to `1` or higher to collect the log information.

The higher this value is set, the more log information will be output. When the output log is large, it takes less time to overwrite the old error log information with the new information.

- Setting by using the Options window

  Select **Trace level** from the pull-down list box.

- Setting by using the `set` operation

  The following is an example command to set the trace level.

  ```
  >dlnkmgr set -systflv 1
  ```

  Specify the trace level in a number.

3.5.2.9 Setting Error Log File Size

There are two error logs: the HDLM manager log file `dlmmgr`*n*`.log` (*n* indicates a file number from `1` to `16`) and the HDLM GUI log file `dlmgui`*n*`.log` (*n* indicates a file number of `1` or `2`).

You can specify a value (in kilobytes) from 100 to 2000000 for the error log file size. For HDLM GUI logs, the valid range of a file size is from 100 to 9900. If you specify a value of 9901 or more, 9900 is applied. The specified value is applied for HDLM manager logs.

When an error log file reaches the specified size, the information in the old error log file is replaced with new information, beginning with the oldest file. By specifying both the log file size and the number of log files, you can collect up to 32000000KB (approximately 30GB) of error logs in total.

- Setting by using the Options window

  For **File size** (for **Error log**), specify a value in kilobytes. To apply the error log file size you specified in the Options window of the HDLM GUI to the HDLM GUI log file `dlmgui`*n*`.log` (*n* indicates a file number of `1` or `2`), restart the HDLM GUI.

- Setting by using the `set` operation

  The following shows an example of executing the command to set the error log file size.

  ```
  >dlnkmgr set -elfs 1000
  ```

  Specify the size of the error log file in kilobytes.

3.5.2.10 Setting the Number of Error Log Files

The number of the error log files can be set.

There are two error logs: the HDLM manager log file `dlmmgr`*`n`*`.log` (*n* indicates a file number from `1` to `16`) and the HDLM GUI log file `dlmgui`*`n`*`.log` (*n* indicates a file number of `1` or `2`). The error logs you can set in the Options window and the `set` operation are limited to the HDLM manager logs file `dlmmgr`*`n`*`.log` (*n* indicates a file number from `1` to `16`). The number of files for the HDLM GUI log file `dlmgui`*`n`*`.log` (*n* indicates a file number of `1` or `2`) is fixed to 2.

You can specify a value from 2 to 16 for the number of error log files (log files for the HDLM manager).

By specifying both the log file size and the number of log files, you can collect up to 32000000KB (approximately 30GB) of error logs in total.

- Setting by using the Options window

  For **Number of files** (for **Error log**), specify the number of error log files by using numeric characters.

- Setting Number of Error Log Files using Set Operation

  The following shows an example of setting the number of error log files.

  ```
  >dlnkmgr set -elfn 5
  ```

  Specify the number of error log files by using numeric characters.

3.5.2.11 Setting the Trace File Size

The trace file size can be set.

Trace files for which a trace file size can be set are `hdlmtr`*`n`*`.log` (*n* indicates a file number from `1` to `64`). The length of a trace file is fixed. Thus, even if the amount of written trace information is less than the set file size, the file size of each output trace file is always fixed.

For the trace file size, you can specify a value (in kilobytes) from 100 to 16000. If you specify a value smaller than the setting value, the message (KAPL02080-W for the Options window and KAPL01097-W for the `set` operation) is displayed to confirm execution, and the trace file is temporarily deleted.

Once trace data has been written to all the trace files, the oldest file is overwritten with new trace data.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000KB of trace data in total.

- Setting by using the Options window

  For **File size** (for **Trace**), specify a value in kilobytes.

- Setting Trace File Size using Set Operation

  The following shows an example of setting the trace file size:

  ```
  >dlnkmgr set -systfs 2000
  ```

  Specify the size of the trace file in kilobytes.

3.5.2.12 Setting the Number of Trace Files

You can set the number of trace files.

Trace files for which the number of files can be set are `hdlmtr`*`n`*`.log` (*n* indicates a file number from `1` to `64`).

For the number of trace files, you can specify a value from 2 to 64. If you specify a value smaller than the setting value, the message (KAPL02080-W for the Options window and KAPL01097-W for the `set` operation) is displayed to confirm execution, and the trace file is temporarily deleted.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000KB of trace data in total.

- Setting by using the Options window

  For **Number of files** (for **Trace**), specify the number of trace files by using numeric characters.

- Setting Number of Trace Files using Set Operation

  The following shows an example of setting the number of trace files:

  ```
  >dlnkmgr set -systfn 10
  ```

  Specify the number of trace files by using numeric characters.

3.5.3 Applying the Settings and Closing the Windows

This section describes steps involved in closing the Options window of the HDLM GUI and how to check the new settings by using the `dlnkmgr` command's `set` operation after the new settings are applied.

3.5.3.1 Closing the Options Window When Using HDLM GUI

When using the HDLM GUI, follow these steps to close the Options window:

1. Click the **OK** button. The settings are applied and then the Options window is closed.
2. Click the **Close** button in the Path Management window. The Path Management window is closed.

If you change the setting for the error log file size in the Options window, the changed value is not applied to the HDLM GUI log file `dlmgui`*`n`*`.log` (*`n`* indicates a file number of `1` or `2`) until HDLM GUI is restarted. When the other values are changed, click the **OK** button or **Apply** button. The changed values are applied.

3.5.3.2 Checking New Settings Using the dlnkmgr Command

When you change these settings, you can display information about all HDLM functionality settings. The following shows an example of executing the command:

```
>dlnkmgr view -sys -sfunc
HDLM Version                  : xx-xx
Service Pack Version          :
Load Balance                  : on(rr)
Support Cluster               : off
Elog Level                    : 2
Elog File Size(KB)            : 1000
Number Of Elog Files          : 5
Trace Level                   : 1
Trace File Size(KB)           : 2000
Number Of Trace Files         : 10
Path Health Checking          : on(10)
Auto Failback                 : on(10)
Remove LU                     : on
Intermittent Error Monitor    : on(2/20)
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

3.6 Installing HDLM

Before installing, check whether HDLM has been installed on the installation-target host. When HDLM has been installed on the host, you can upgrade HDLM by performing an update installation as described in section 3.6.4 or 3.6.5.

When you install HDLM, Hitachi Network Objectplaza Trace Library will also be installed. The file path of the integrated trace information file of Hitachi Network Objectplaza Trace Library is *installation-destination-drive*:\Program Files\HITACHI\HNTRLib2\spool\Hntr2*n*.log, where *n* is the number of the integrated trace information file. In Windows Server 2003 (IPF and x64), replace Program Files with Program Files (x86).

3.6.1 Preparations for a New Installation of HDLM

For an FC connection, check the topology (Fabric, AL, etc.) and perform setup as appropriate.

To prepare for HDLM installation:

1. Use a single cable to connect the host to the storage system (single path configuration).

   Using multiple paths to connect a host and a storage system (a multi-path configuration) before installing HDLM may cause unstable Windows operation. Make sure that you use a single-path configuration until HDLM installation finishes.

   Figure 3.3 shows a single path configuration and a multi-path configuration.

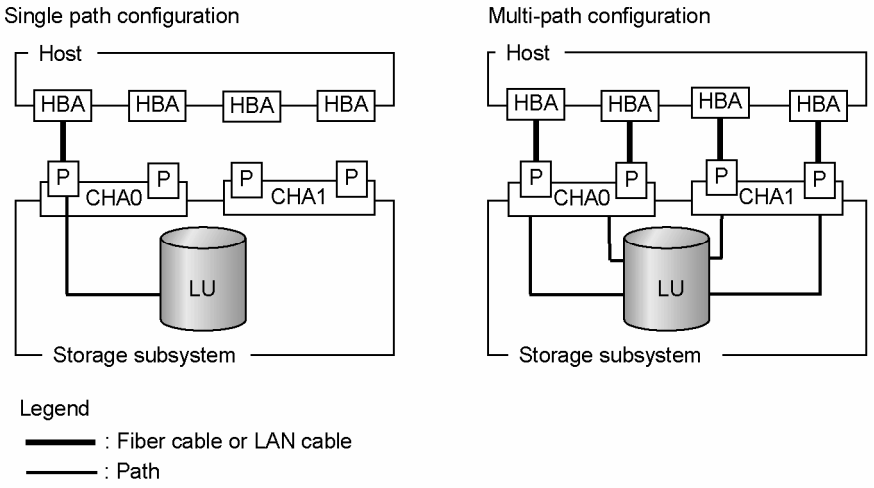


Figure 3.3 Single Path Configuration and Multi-Path Configuration

2. To set up the storage system, assign an LU to each port. Change the settings of the storage system according to the hardware notes supplied with HDLM.
3. Install the HBAs onto the host. In a cluster configuration, make sure that the manufacturer and model of the HBA is the same for all the hosts that make up the cluster. Also make sure that the versions of the HBA micro-programs are the same.
4. Set up the switches. For details on how to set up a switch, see the documentation for the switch. This step is unnecessary if you do not use a switch.
5. Set up the BIOS for the HBAs, whether or not paths exist. The settings depend on the topology to be used. For details on how to set up the BIOS, see the documentation for the HBA.
6. Install Windows, and any non-HDLM driver according to the documentation for each product.
7. Set up the HBAs. See the hardware notes provided with HDLM and the relevant HBA manual to complete the required setup.
8. If your configuration uses an IP-SAN, install and set up the iSCSI initiator (iSCSI software or HBA). For details on setup, see the iSCSI initiator documentation, the Hardware notes provided with HDLM, or the storage system documentation.
9. Prepare the LUs. Write signatures, create partitions, and then format. Since the system is in the single path configuration, you can write signatures for all the LUs.
10. Restart the host.
11. Confirm that the host is operating normally.

3.6.2 Preparations for installing HDLM by performing an unattended installation

An unattended installation allows a user to install HDLM without needing to enter information into dialog boxes. Instead, the user defines the required dialog box information in an installation-information settings file prior to installation. The unattended installation procedure is as follows:

1. Define the information required for the installation in the installation-information settings file.
2. Execute `installhdlm.exe` to start installing HDLM.
3. Information is automatically entered into dialog boxes according to the contents of the installation-information settings file.
4. The installation ends. A log is output, showing the status and result of the installation.

This section describes the following aspects of an unattended installation:

- How to define an installation-information settings file
- Installation information settings
- Log files
- Notes on installation

For details on how to install HDLM by using an unattended installation, see section 3.6.3.1.

3.6.2.1 How to define an installation-information settings file

In an installation-information settings file, you need to define the license key file name, installation destination folder, and other keys that are required for installation. A sample of an installation-information settings file (`installhdml.ini`) is included in the supplied CD-ROM. To create a new settings file, simply copy and edit this sample.

To edit the installation-information settings file (`installhdml.ini`):

1. Create a copy of `installhdml.ini`, which is located in the supplied CD-ROM, and move it to any folder.

   Location of `installhdml.ini`:

   drive-to-which-the-installation-CD-ROM-is-inserted`:\DLMTools`

2. Use a text editor to edit the copy of `installhdml.ini` that was created in step 1.

   Items that need to be defined in the installation-information settings file (`installhdml.ini`) are described in section 3.6.2.2 below.

3. Save `installhdml.ini`.

3.6.2.2 Items to be defined in an installation-information settings file

Items (keys) to be defined in an installation-information settings file are listed in Table 3.14. Do not modify any keys that are not listed in the table.

Table 3.14 Keys in an installation-information settings file (installhdml.ini)

Key name	Description	Necessity of definition		Maximum character length[#1]
		New installation	Upgrade installation	
workdir	Specify an absolute path to an output folder. Installation logs and processing files are output to this folder.[#2, #3] If this key is omitted, the installer uses the folder path that has been specified for the environment variable TMP or TEMP.	Optional	Optional	100
licensekeyfile	Specify an absolute path to a license key file stored in the host.[#2, #3] If this key is omitted, the installer uses the following license key file (default): *Windows-installation-drive*:\hdlm_license	Optional[#4]	Optional[#4]	100
installdir	Specify an absolute path to an installation destination folder for HDLM.[#2, #3] If this key is omitted, the installer uses the following folder (default): *Windows-installation-drive*:\Program Files\HITACHI\DynamicLinkManager[#5]	Optional	Not required	100
name	Specify the name of the user.[#3]	Optional	Not required	72
company	Specify the name of the company to which the user belongs.[#3]	Optional	Not required	72
storage_emc	Specify either of the following values to indicate whether to include the EMC DMX series and EMC CX series as management targets of HDLM:[#2] y: Include them as management targets. n: Do not include them as management targets (default).	Optional	Optional	1
storage_eva	Specify whether to include the HP EVA series as management targets of HDLM. Specify either of the following values:[#2] y: Include them as management targets. n: Do not include them as management targets (default).	Optional	Optional	1
restart	Specify whether to restart the system after installation. Specify either of the following values:[#2] y: Restart. n: Do not restart (default). In a cluster environment, do not specify y (restart).	Optional	Optional	1

Legend:

Optional: Specification is optional. If no value is specified for the key, the installer uses the default.

Not required: Specification is unnecessary. If a value is specified for the key, the installer ignores the specified value.

#1

If the length of the value exceeds the maximum length, an error will occur.

#2

If the value is not of an allowable type, an error will occur.

#3

The value to be specified does not have to be enclosed within double quotation marks ("), even if the value includes space characters.

#4

When you perform a new installation of HDLM, or when you perform an upgrade installation while the license is expired, prepare the license key file.

#5

In the Windows Server 2003 (IPF and x64):

Windows-installation-drive:\Program Files (x86)\HITACHI\DynamicLinkManager

An example of editing installhdlm.ini is as follows:

```
[INSTALLATION_SETTINGS]
workdir=
licensekeyfile=C:\temp\hdlm_license
installdir=D:\Program files\HITACHI\DynamicLinkManager
name=
company=
storage_emc=n
storage_eva=n
restart=n
```

3.6.2.3 Log file

A log file (installhdlm.log) is output after an unattended installation of HDLM.

installhdlm.log file

installhdlm.log is created in the folder whose path is specified by the workdir key in the installation-information settings file. If installhdlm.log already exists, log information is added to this log file.

Note that installhdlm.log is not deleted after HDLM is uninstalled. Therefore, delete the original installhdlm.log manually if it is no longer required.

3.6.2.4 Notes on installation

- Do not forcibly stop the execution of `installhdlm.exe` during an unattended installation of HDLM. If you forcibly stop the execution of `installhdlm.exe` (for example, if you press **Ctrl** + **C**), HDLM installation will not be stopped. If you have specified `y` for the `restart` key in the installation-information settings file, the computer will restart when the installation finishes successfully. Therefore, make sure that you check the results of the installation in `installhdlm.log` if you have forcibly stopped the execution of `installhdlm.exe`.

3.6.3 Performing a New Installation of HDLM

3.6.3.1 Performing a New Installation in a Non-Cluster Environment

Before installing HDLM, prepare a license key.

If you want to perform an unattended installation, prepare the installation-information settings file in which information required for the installation has already been defined.

To install HDLM on a host that does not currently contain HDLM:

1. Log on to the Windows system as a member of the administrators group.
2. Store the license key file directly under the Windows installation-destination drive. You can also specify a license key directly without using the license key file.

   ```
   installation-drive:\hdlm_license
   ```

   The license key file will be deleted when the installation finishes.
3. Perform the installation.
   - If you do not want to perform an unattended installation, insert the CD-ROM into the drive, and then start the installation program `setup.exe`.

     The program checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, perform the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, the KAPL09173-W message appears. In this case, perform the procedure shown in section 3.6.4. If no message appears, go to step 4.
   - If you want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `installhdlm.exe`.

     At the command prompt, execute the following command:

     drive-to-which-the-installation-CD-ROM-is-inserted`:\DLMTools\installhdlm.exe -f` *installation-information-settings-file* `(installhdlm.ini)`

     This command checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, carry out the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, an upgrade installation is performed, and then the KAPL09183-I message appears.

If you have specified `n` (do not restart) for the `restart` key in the installation-information settings file, go to step 12.

If you have specified `y` (restart) for the `restart` key in the installation-information settings file, go to step 17.

4. The program checks the version of the MPIO driver, and then installs the MPIO driver. If a message appears, asking you whether you want to install MPIO driver, follow the procedure below:
   - The KAPL09127-W message appears if MPIO driver has already been installed and its version does not match the version of MPIO driver to be installed:
     - Click the **Next** button to install MPIO driver.
     - Click the **Cancel** button to cancel the installation.
   - If no message appears, go to the next step.
5. Follow the instructions shown in the messages that appear on the window. If a license key file was stored in step 2, specify that license key file. If a license key file is not used, specify the license key directly.
6. Enter user information in accordance with the instructions shown in the messages that appear on the window.
7. Specify the installation folder in accordance with the instructions shown in the messages that appear on the window.

8. The utility for registering HDLM persistent reservation keys (`dlmprsvkey`) is automatically executed to create a PRSV key. The PRSV key is required for the HDLM functions to operate normally. Also, the value of the PRSV key must be unique among hosts. Creation of the PRSV key may be unsuccessful if, for example, an NIC does not exist. Do one of the following in accordance with the result of the execution of the `dlmprsvkey` utility:
   - If the key creation is successful, the created PRSV key appears in the dialog box. If you do not need to change the value, click the **Next** button. If you must change the value because another host already has the same PRSV key, change the value and then click the **Next** button. If you want to undo the change, click the **Back** button and then start over from step 7.
   - If the key creation is unsuccessful, a dialog box appears that prompts you for the PRSV key. Enter the PRSV key, and then click the **OK** button.

   For the values you can specify for the PRSV key, follow the instructions shown in the installation program window.
9. The program checks the PRSV key. If the KAPL09128-W message appears, follow the procedure below:
   - You are prompted to re-enter the PRSV key. Enter an appropriate PRSV key. The program then checks the PRSV key again.
   - If no message appears, go to the next step.
10. Select an HDLM management-target device only when the operating system is one of the following:
    - Windows Server 2003 (IA32) SP1 or later
    - Windows Server 2003 (IPF) SP1 or later

    The **Hitachi USP V, TagmaStore, Lightning, Thunder Series and HP StorageWorks XP Series** option is always selected. To select the EMC DMX series and EMC CX series as the HDLM management-target device, select **EMC Symmetrix DMX Series, CLARiiON CX Series**. To select the HP EVA series as the HDLM management-target device, select **HP StorageWorks EVA Series**.
11. Follow the instructions shown in the messages that appear on the window.
    - If a dialog box that begins with the following sentence appears during installation, and the Storport Miniport driver is used as the HBA driver, stop the HDLM installation. Then, install QFE838894 or a later version of the Microsoft Storport driver, or install Windows Server 2003 SP1 or later.

      Notes on using a Storport Miniport driver:

      Read these notes before using a Storport Miniport driver as an HBA driver.

      The file version of the Storport.sys of this system (Microsoft Storport driver) is n.n.nnnn.n.

      When using a Storport Miniport driver as an HBA driver:

      Update the Storport Miniport driver to a Storport.sys with a file version n.n.nnnn.n or later.
    - The PRSV key is registered before the installation finishes. If the KAPL09131-W message appears, follow the procedure described in step 13.

12. Check the results of the installation.

    If you performed an unattended installation, check the installation results in the command prompt.

13. When the installation finishes, execute the `dlmprsvkey` utility with the `-v` parameter specified.

    Make sure that the PRSV key displayed by the `dlmprsvkey` utility is unique among those of any other hosts in the SAN. If the PRSV key is not unique or is not registered, or if the KAPL09131-W message appears, execute the `dlmprsvkey` utility with the `-r` parameter specified to re-register the PRSV key. If the PRSV key is not registered, the HDLM functions may not operate normally. For details about the `dlmprsvkey` utility, see section 8.4.

    If you used the license key file, it will be deleted when the installation finishes. The KAPL09115-W message appears if deletion of this file fails. In this case, delete the file manually, such as by using Explorer.

14. Shut down the host. Leave the host in a single-path configuration until you check (in step 21) whether HDLM has been successfully installed.

15. Modify the settings in the storage system. Modify the settings in the storage system according to the procedure described in the hardware notes provided with HDLM.

16. Start the host.

17. Log on to the Windows system again as a member of the Administrators group.

18. Check the log file and PRSV key.

    If you installed HDLM by using an unattended installation and specified `y` (restart) for the `restart` key in the installation-information settings file, make sure that the KAPL09181-I message is output to `installhdlm.log`. For details about this log file, see section 3.6.2.3 or 3.6.2.4.

    Make sure that the PRSV key displayed by the `dlmprsvkey` utility is unique among the hosts in the SAN. If the PRSV key is not unique or is not registered, or if the KAPL09131-W message appears, execute the `dlmprsvkey` utility with the `-r` parameter specified to re-register the PRSV key. If the PRSV key is not registered, HDLM functions might not operate normally. For details about the `dlmprsvkey` utility, see section 8.4. If you used the license key file, it will be deleted when the installation finishes. The KAPL09115-W message appears if deletion of this file fails. In this case, delete the file manually, such as by using Explorer.

19. Log on to the Windows system again as a member of the administrators group.

20. Execute the `dlnkmgr` command's `view` operation to display the status of each program.

    An example of executing the `dlnkmgr` command's `view` operation follows:

```
>dlnkmgr view -sys
HDLM Version               : xx-xx
Service Pack Version       :
Load Balance               : on(rr)
Support Cluster            : off
Elog Level                 : 3
Elog File Size (KB)        : 9900
Number Of Elog Files       : 2
```

```
Trace Level                    : 0
Trace File Size(KB)            : 1000
Number Of Trace Files          : 4
Path Health Checking           : on(30)
Auto Failback                  : off
Remove LU                      : off
Intermittent Error Monitor     : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive            xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

21. Use the results of the view operation to check the version of the installed HDLM. When 05-91 is displayed in `HDLM Version`, the correct version of HDLM has been installed.

22. Use the results of the view operation to check that the programs are running properly. If `HDLM Manager`, `HDLM Alert Driver`, and `HDLM Driver` are all `Alive`, all programs are running correctly.

23. Check the path information as described in 3.7, and make sure that you have successfully installed HDLM in a single-path configuration.

24. Connect cables to all HBAs (multi-path configuration).

    Figure 3.4 shows a single path configuration and a multi-path configuration.

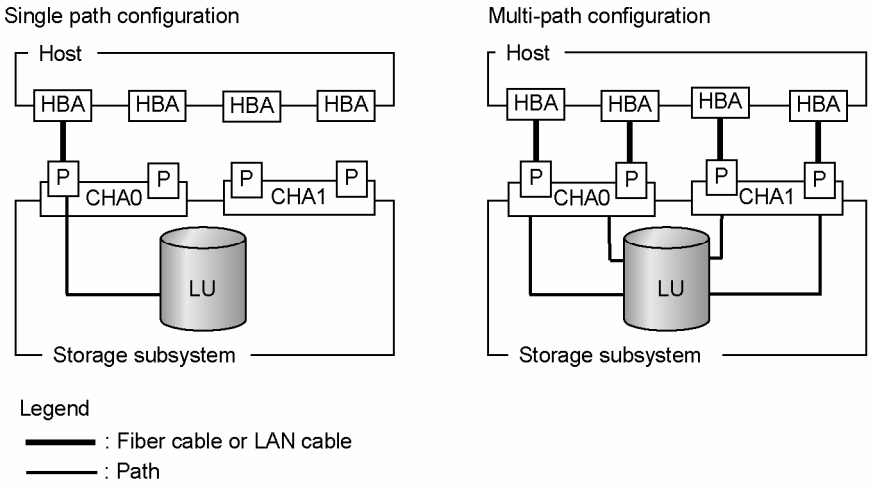


Figure 3.4 Single Path Configuration and Multi-Path Configuration

25. Check the path information as described in Figure 3.4 to make sure that you have successfully built a multi-path configuration.

3.6.3.2 Performing a New Installation Using MSCS

The following provides separate explanations of the procedures for when installing MSCS after HDLM installation, and for when installing HDLM after MSCS installation.

Installing MSCS After HDLM Installation

1. Shut down all the hosts.
2. Make sure that all the hosts comprising the cluster system have been fully shut down.
3. Start the hosts individually in the single path configuration.
4. Log on to Windows as a member of the administrators group.
5. Store the license key file directly under the Windows installation-destination drive. You can also specify the license key directly without using the license key file.

   installation-drive:\hdlm_license

   The license key file will be deleted when the installation finishes.
6. Perform the installation.
   - If you do not want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `setup.exe`.

     The program checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, perform the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, the KAPL09173-W message appears. In this case, perform the procedure shown in section 3.6.4. If no message appears, go to step 7.
   - If you want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `installhdlm.exe`.

     At the command prompt, execute the following command:

     drive-to-which-the-installation-CD-ROM-is-inserted`:\DLMTools\installhdlm.exe -f` *installation-information-settings-file* `(installhdlm.ini)`

     Specify `n` (do not restart) for the `restart` key in the installation-information settings file.

     This command checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, carry out the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, an upgrade installation is performed, and then the KAPL09183-I message appears.

     After the installation is complete, go to step 15.
7. The program checks the version of the MPIO driver, and then installs the MPIO driver. If a message appears asking you whether you want to install MPIO driver, follow the procedure below:
   - The KAPL09127-W message appears if MPIO driver has already been installed and its version does not match the version of MPIO driver to be installed.
     - Click the **Next** button to install MPIO driver.

- Click the **Cancel** button to cancel the installation.

- If no message appears, go to the next step.

8. Specify a license key file or enter a license key in accordance with the instructions shown in the messages that appear on the window. If a license key file was stored in step 5, specify that license key file. If a license key file is not used, specify the license key directly.

9. Enter user information in accordance with the instructions shown in the messages that appear on the window.

10. Specify the installation folder in accordance with the instructions shown in the messages that appear on the window.

11. The utility for registering HDLM persistent reservation keys (`dlmprsvkey`) is automatically executed to create a PRSV key. The PRSV key is required for the HDLM functions to operate normally. Also, the value of the PRSV key must be unique among hosts. Creation of the PRSV key may be unsuccessful if, for example, an NIC does not exist. Do one of the following in accordance with the result of the execution of the `dlmprsvkey` utility:

    - If the key creation is successful, the created PRSV key appears in the dialog box. If you do not need to change the value, click the **Next** button. If you must change the value because another host already has the same PRSV key, change the value, and then click the **Next** button. If you want to undo the change, click the **Back** button and then start over from step 10.

    - If the creation is unsuccessful, a dialog box appears that prompts you for the PRSV key. Enter the PRSV key, and then click the **OK** button.

    For the values you can specify for the PRSV key, follow the instructions shown in the installation program window.

12. The program checks the PRSV key. If the KAPL09128-W message appears, follow the procedure below:

    - You are prompted to re-enter the PRSV key. Enter an appropriate PRSV key. The program then checks the PRSV key again.

    - If no message appears, go to the next step.

13. Select an HDLM management-target device only when the operating system is one of the following:

    - Windows Server 2003 (IA32) SP1 or later

    - Windows Server 2003 (IA32) R2

    - Windows Server 2003 (IPF) SP1 or later

    The **Hitachi USP V, TagmaStore, Lightning, Thunder Series and HP StorageWorks XP Series** option is always selected. To select the EMC DMX series and EMC CX series as the HDLM management-target device, select **EMC Symmetrix DMX Series, CLARiiON CX Series**. To select the HP EVA series as the HDLM management-target device, select **HP StorageWorks EVA Series**.

14. Follow the instructions shown in the messages that appear on the window.

- If a dialog box that begins with the following sentence appears during installation, and the Storport Miniport driver is used as the HBA driver, stop the HDLM installation. Then, install QFE838894 or a later version of the Microsoft Storport driver, or install Windows Server 2003 SP1or later.

  Notes on using a Storport Miniport driver:

  Read these notes before using a Storport Miniport driver as an HBA driver.

  The file version of the Storport.sys of this system (Microsoft Storport driver) is n.n.nnnn.n.

  When using a Storport Miniport driver as an HBA driver:

  Please update the Storport Miniport driver to a Storport.sys with a file version n.n.nnnn.n or later.

- The PRSV key is registered before the installation finishes. If the KAPL09131-W message appears, follow the procedure described in step 16.

15. Check the results of the installation.

    If you performed an unattended installation, check the installation results in the command prompt.

16. When the installation finishes, execute the `dlmprsvkey` utility with the `-v` parameter specified. Make sure that the PRSV key displayed by the `dlmprsvkey` utility is unique among those of any other hosts in the SAN. If the PRSV key is not unique or is not registered, or if the KAPL09131-W message appears, execute the `dlmprsvkey` utility with the `-r` parameter specified to re-register the PRSV key. If the PRSV key is not registered, the HDLM functions may not operate normally. For details about the `dlmprsvkey` utility, see section 8.4.

    If you used the license key file, it will be deleted when the installation finishes. The KAPL09115-W message appears if deletion of this file fails. In this case, delete the file manually, such as by using Explorer.

17. Shut down the host. Leave the host in a single-path configuration until you check (in step 25) whether HDLM has been successfully installed.

18. On all the hosts comprising the cluster system, perform steps 3 through 17.

19. Make sure that all the hosts comprising cluster system have been completely shut down.

20. Start the host individually.

21. Log on to the Windows system again as a member of the administrators group.

22. Execute the `dlnkmgr` command's `view` operation to display the status of each program:

    An example of executing the `dlnkmgr` command's `view` operation is as follows:

```
>dlnkmgr view -sys
HDLM Version                : xx-xx
Service Pack Version        :
Load Balance                : on(rr)
Support Cluster             : off
Elog Level                  : 3
Elog File Size (KB)         : 9900
Number Of Elog Files        : 2
Trace Level                 : 0
Trace File Size(KB)         : 1000
```

```
Number Of Trace Files       : 4
Path Health Checking        : on(30)
Auto Failback                 : off
Remove LU                      : off
Intermittent Error Monitor  : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

23. Use the results of the dlnkmgr command's view operation to check the version of the installed HDLM. When `05-91` is displayed in `HDLM Version`, the correct version of HDLM has been installed.
24. Use the results of the `dlnkmgr` command's `view` operation to check that the programs are running properly. If `HDLM Manager`, `HDLM Alert Driver`, and `HDLM Driver` are all Alive, all programs are running correctly.
25. After installation finishes, check the path information as described in 3.7, and make sure that you have successfully installed HDLM in a single-path configuration.
26. Connect cables with all HBAs (multi-path configuration).
27. Check the path information as described in 3.7 to make sure that you have successfully built a multi-path configuration.
28. Shut down the host.
29. On all the hosts comprising the cluster system, perform the operations from step 20 to step 28.
30. Start the host individually.
31. Install MSCS.
32. Shut down all hosts after completing installation of MSCS in all hosts configured in MSCS.
33. Start the host individually.
34. Log on to the Windows system again as a member of the administrators group.
35. Make sure that the program is working normally, by examining the results of the `dlnkmgr` command's `view` operation.

    Make sure that `on MSCS` is displayed in `Support Cluster`. An example of executing the `dlnkmgr` command's `view` operation is as follows:

```
>dlnkmgr view -sys
HDLM Version               : xx-xx
Service Pack Version       :
Load Balance               : on(rr)
Support Cluster            : on MSCS
Elog Level                 : 3
Elog File Size (KB)        : 9900
Number Of Elog Files       : 2
Trace Level                : 0
```

```
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : off
Remove LU                    : off
Intermittent Error Monitor   : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

Installing HDLM After MSCS Installation

To install HDLM on a host that does not currently contain HDLM:

1. Install MSCS on the host.
2. Restart the host.
3. Log on to Windows as a member of the administrators group.
4. Store the license key file directly under the Windows installation-destination drive. You can also specify the license key directly without using the license key file.

   installation-drive:\hdlm_license

   The license key file will be deleted when the installation finishes.
5. Perform the installation.
   - If you do not want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `setup.exe`.

     If HDLM has been installed, the KAPL09129-E message appears. In this case, perform the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, the KAPL09173-W message appears. In this case, perform the procedure shown in section 3.6.4. If no message appears, go to step 6.
   - If you want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `installhdlm.exe`.

     At the command prompt, execute the following command:

     drive-to-which-the-installation-CD-ROM-is-inserted:\DLMTools\installhdlm.exe -f *installation-information-settings-file* (installhdlm.ini)

     Specify `n` (do not restart) for the `restart` key in the installation-information settings file.

     This command checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, carry out the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, an upgrade installation is performed, and then the KAPL09183-I message appears.

     After the installation is complete, go to step 14.

6. The program checks the version of the MPIO driver, and then installs the MPIO driver. If a message appears asking you whether you want to install MPIO driver, follow the procedure below:
   - The KAPL09127-W message appears if MPIO driver has already been installed and its version does not match the version of MPIO driver to be installed:
     - Click the **Next** button to install MPIO driver.
     - Click the **Cancel** button to cancel the installation.
   - If no message appears, go to the next step.
7. Specify a license key file or enter a license key in accordance with the instructions shown in the messages that appear on the window:
   - If a license key file was stored in step 4, specify that license key file.
   - If a license key file is not used, specify the license key directly.
8. Enter user information in accordance with the instructions shown in the messages that appear on the window.
9. Specify the installation folder in accordance with the instructions shown in the messages that appear on the window.
10. The utility for registering HDLM persistent reservation keys (dlmprsvkey) is automatically executed to create a PRSV key. The PRSV key is required for the HDLM functions to operate normally. Also, the value of the PRSV key must be unique among hosts. Creation of the PRSV key may be unsuccessful if, for example, an NIC does not exist. Do one of the following in accordance with the result of the execution of the dlmprsvkey utility:
    - If the key creation is successful, the created PRSV key appears in the dialog box. If you do not need to change the value, click the **Next** button. If you must change the value because another host already has the same PRSV key, change the value, and then click the **Next** button. If you want to undo the change, click the **Back** button and then start over from step 9.
    - If the creation is unsuccessful, a dialog box appears that prompts you for the PRSV key. Enter the PRSV key, and then click the **OK** button.

    For the values you can specify for the PRSV key, follow the instructions shown in the installation program window.
11. The program checks the PRSV key. If the KAPL09128-W message appears:
    - Re-enter an appropriate PRSV key. The program then checks the PRSV key again.
    - If no message appears, go to the next step.
12. Select an HDLM management-target device only when the operating system is one of the following:
    - Windows Server 2003 (IA32) SP1 or later
    - Windows Server 2003 (IPF) SP1 or later

    The **Hitachi USP V, TagmaStore, Lightning, Thunder Series and HP StorageWorks XP Series** option is always selected. To select the EMC DMX series and EMC CX series as the HDLM management-target device, select **EMC Symmetrix DMX Series, CLARiiON CX Series**. To select the HP EVA series as the HDLM management-target device, select **HP StorageWorks EVA Series**.

13. Follow the instructions shown in the messages that appear in the window.
    - If a dialog box that begins with the following sentence appears during installation, and the Storport Miniport driver is used as the HBA driver, stop the HDLM installation. Then, install QFE838894 or a later version of the Microsoft Storport driver, or install Windows Server 2003 SP1.

      Notes on using a Storport Miniport driver:

      Read these notes before using a Storport Miniport driver as an HBA driver.

      The file version of the Storport.sys of this system (Microsoft(R) Storport driver) is n.n.nnnn.n.

      When using a Storport Miniport driver as an HBA driver:

      Please update the Storport Miniport driver to a Storport.sys with a file version n.n.nnnn.n or later.
    - The PRSV key is registered before the installation finishes. If the KAPL09131-W message appears, follow the procedure described in step 15.
14. Check the results of the installation.

    If you performed an unattended installation, check the installation results in the command prompt.
15. When the installation finishes, execute the dlmprsvkey utility with the -v parameter specified. Make sure that the PRSV key displayed by the `dlmprsvkey` utility is unique among those of any other hosts in the SAN. If the PRSV key is not unique or is not registered, or if the KAPL09131-W message appears, execute the `dlmprsvkey` utility with the `-r` parameter specified to re-register the PRSV key. If the PRSV key is not registered, the HDLM functions may not operate normally. For details about the utility, see section 8.4.

    If you are using the license key file, it will be deleted when the installation finishes. The KAPL09115-W message appears if deletion of this file fails. In this case, delete the file manually, such as by using Explorer.
16. Shut down the host. Leave the host in a single-path configuration until you check (in step 25) whether HDLM has been successfully installed.
17. On all the hosts comprising the cluster system, perform the operations from step 1 to step 16.
18. Confirm that all the hosts making up the cluster system have been shut down.
19. Modify the settings in the storage system according to the procedure described in the hardware notes provided with HDLM.
20. Start the host individually.
21. Log on to the Windows system again as a member of the administrators group.

22. Make sure that the program is working normally, by examining the results of the command's `view` operation. Make sure that `on MSCS` is displayed in `Support Cluster`. An example of executing the `dlnkmgr` command's `view` operation is as follows:

```
>dlnkmgr view -sys
HDLM Version               : xx-xx
Service Pack Version       :
Load Balance               : on(rr)
Support Cluster            : on MSCS
Elog Level                 : 3
Elog File Size (KB)        : 9900
Number Of Elog Files       : 2
Trace Level                : 0
Trace File Size(KB)        : 1000
Number Of Trace Files      : 4
Path Health Checking       : on(30)
Auto Failback              : off
Remove LU                  : off
Intermittent Error Monitor  : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

23. Use the results of the `dlnkmgr` command's `view` operation to check the version of the installed HDLM. When `05-91` is displayed in `HDLM Version`, the correct version of HDLM has been installed.

28. Use the results of the view operation to check that the programs are running properly.

    If `HDLM Manager`, `HDLM Alert Driver`, and `HDLM Driver` are all Alive, all programs are running correctly.

29. After installation finishes, check the path information as described in section 3.7, and make sure that you have successfully installed HDLM in a single-path configuration.

30. Connect cables to all HBAs (multi-path configuration).

31. Check the path information as described in section 3.7 to make sure that you have successfully built a multi-path configuration.

3.6.3.3 Performing a New Installation Using VCS

1. Start the hosts individually in the single path configuration.
2. Use the VCS Configuration Wizard to configure Cluster Components.
3. Restart the host.
4. Log on to the Windows system as a member of the administrators group.
5. Stop VCS.
6. Store the license key file directly under the Windows installation-destination drive. You can also specify the license key directly without using the license key file.

   ```
   installation-drive:\hdlm_license
   ```

   The license key file will be deleted when the installation finishes.
7. Perform the installation.
   - If you do not want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `setup.exe`.

     If HDLM has been installed, the KAPL09129-E message appears In this case, perform the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, the KAPL09173-W message appears. In this case, perform the procedure shown in section 3.6.4. If no message appears, go to step 8.
   - If you want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `installhdlm.exe`.

     At the command prompt, execute the following command:

     drive-to-which-the-installation-CD-ROM-is-inserted`:\DLMTools\installhdlm.exe -f` *installation-information-settings-file* `(installhdlm.ini)`

     Specify `n` (do not restart) for the `restart` key in the installation-information settings file.

     This command checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, carry out the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, an upgrade installation is performed, and then the KAPL09183-I message appears.

     After the installation is complete, go to step 16.
8. The program checks the version of the MPIO driver, and then installs the MPIO driver. If a message appears asking you whether you want to install MPIO driver, follow the procedure below:
   - The KAPL09127-W message appears if MPIO driver has already been installed and its version does not match the version of MPIO driver to be installed:
     - Click the **Next** button to install MPIO driver.
     - Click the **Cancel** button to cancel the installation.
   - If no message appears, go to the next step.

9. Specify a license key file or enter a license key in accordance with the instructions shown in the messages that appear on the window. If a license key file was stored in step 6, specify that license key file. If a license key file is not used, specify the license key directly.
10. Enter user information in accordance with the instructions shown in the messages that appear on the window.
11. Specify the installation folder in accordance with the instructions shown in the messages that appear on the window.
12. The utility for registering HDLM persistent reservation keys (`dlmprsvkey`) is automatically executed to create a PRSV key. The PRSV key is required for the HDLM functions to operate normally. Also, the value of the PRSV key must be unique among hosts. Creation of the PRSV key may be unsuccessful if, for example, an NIC does not exist. Do one of the following in accordance with the result of the execution of the `dlmprsvkey` utility:
    - If the creation is successful, the created PRSV key appears in the dialog box. If you do not need to change the value, click the **Next** button. If you must change the value because another host already has the same PRSV key, change the value, and then click the **Next** button. If you want to undo the change, click the **Back** button and then start over from step 11.
    - If the creation is unsuccessful, a dialog box appears that prompts you for the PRSV key. Enter the PRSV key, and then click the **OK** button.

    For the values you can specify for the PRSV key, follow the instructions shown in the installation program window.
13. The program checks the PRSV key. If the KAPL09128-W message appears, follow the procedure below:
    - You are prompted to re-enter the PRSV key. Enter an appropriate PRSV key. The program then checks the PRSV key again.
    - If no message appears, go to the next step.
14. The message **Select Storage System to be managed.** is displayed: click the **Next** button. In a VCS environment, the EMC DMX series and EMC CX series cannot be set as an HDLM management-target device. Thus, do not select **EMC Symmetrix DMX Series, CLARiiON CX Series.** Similarly, the HP EVA series cannot be set as an HDLM management-target device. Accordingly, do not select **HP StorageWorks EVA Series** either.
15. Follow the instructions shown in the messages that appear on the window.
    - If a dialog box that begins with the following sentence appears during installation, and the Storport Miniport driver is used as the HBA driver, stop the HDLM installation. Then, install QFE838894 or a later version of the Microsoft Storport driver, or install Windows Server 2003 SP1 or later.

      Notes on using a Storport Miniport driver:

      Read these notes before using a Storport Miniport driver as an HBA driver.

      The file version of the Storport.sys of this system (Microsoft Storport driver) is n.n.nnnn.n.

      When using a Storport Miniport driver as an HBA driver:

Please update the Storport Miniport driver to a Storport.sys with a file version n.n.nnnn.n or later.

- The PRSV key is registered before the installation finishes. If the KAPL09131-W message appears, follow the procedure described in step 17.

16. Check the results of the installation.

    If you performed an unattended installation, check the installation results in the command prompt.

17. When the installation finishes, execute the `dlmprsvkey` utility with the `-v` parameter specified. Make sure that the PRSV key displayed by the `dlmprsvkey` utility is unique among those of any other hosts in the SAN. If the PRSV key is not unique or is not registered, or if the KAPL09131-W message appears, execute the `dlmprsvkey` utility with the `-r` parameter specified to re-register the PRSV key. If the PRSV key is not registered, the HDLM functions may not operate normally. For details about the `dlmprsvkey` utility, see section 8.4.

    If you used the license key file, it will be deleted when the installation finishes. The KAPL09115-W message appears if deletion of this file fails. In this case, delete the file manually, such as by using Explorer.

18. Shut down the host. Leave the host in a single-path configuration until you check (in step 25) whether HDLM has been successfully installed.

19. Modify the settings in the storage system. Modify the settings in the storage system according to the procedure described in the hardware notes provided with HDLM.

20. Start the host individually.

21. Log on to the Windows system again as a member of the administrators group.

22. Make sure that the program is working normally, by examining the results of the `dlnkmgr` command's `view` operation.

An example of executing the `dlnkmgr` command's `view` operation is as follows:

```
>dlnkmgr view -sys
HDLM Version               : xx-xx
Service Pack Version       :
Load Balance               : on(rr)
Support Cluster            : off
Elog Level                 : 3
Elog File Size (KB)        : 9900
Number Of Elog Files       : 2
Trace Level                : 0
Trace File Size(KB)        : 1000
Number Of Trace Files      : 4
Path Health Checking       : on(30)
Auto Failback              : off
Remove LU                  : off
Intermittent Error Monitor  : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

Even if you are using VCS, `off` appears for `Support Cluster`. Regardless, the cluster support function runs normally.

23. Use the results of the view operation to check the version of the installed HDLM. When `05-91` is displayed in `HDLM Version`, the correct version of HDLM has been installed.
24. Use the results of the view operation to check that the programs are running properly. If `HDLM Manager`, `HDLM Alert Driver`, and `HDLM Driver` are all Alive, all programs are running correctly.
25. After installation finishes, check the path information as described in section 3.7, and make sure that you have successfully installed HDLM in a single-path configuration.
26. Connect cables to all HBAs (multi-path configuration).
27. Check the path information as described in section 3.7 to make sure that you have successfully built a multi-path configuration.

3.6.3.4 Performing a New Installation Using Oracle RAC

1. Shut down all the hosts.
2. Make sure that all the hosts comprising the cluster system have been fully shut down.
3. Start the host individually in the single path configuration.
4. Log on to Windows as a member of the administrators group.
5. Store the license key file directly under the Windows installation-destination drive. You can also specify the license key directly without using the license key file.

   ```
   installation-drive:\hdlm_license
   ```

   The license key file will be deleted when the installation finishes.
6. Perform the installation.
   - If you do not want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `setup.exe`.

     The program checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, perform the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, the KAPL09173-W message appears. In this case, perform the procedure shown in section 3.6.4. If no message appears, go to step 7.
   - If you want to perform an unattended installation, insert the CD-ROM into the drive, and start the installation program `installhdlm.exe`.

     At the command prompt, execute the following command:

     drive-to-which-the-installation-CD-ROM-is-inserted`:\DLMTools\installhdlm.exe -f` *installation-information-settings-file* `(installhdlm.ini)`

     Specify `n` (do not restart) for the `restart` key in the installation-information settings file.

     This command checks whether HDLM has already been installed. If HDLM 5.4 or earlier has been installed, the KAPL09129-E message appears. In this case, carry out the procedure shown in section 3.6.5. If HDLM 5.5 or later has been installed, an upgrade installation is performed, and then the KAPL09183-I message appears.

     After the installation is complete, go to step 15.
7. The program checks the version of the MPIO driver, and then installs the MPIO driver. If a message appears asking you whether you want to install the MPIO driver, follow the procedure below:
   - The KAPL09127-W message appears if MPIO driver has already been installed and its version does not match the version of MPIO driver to be installed:
     - Click the **Next** button to install MPIO driver.
     - Click the **Cancel** button to cancel the installation.
   - If no message appears, go to the next step.

8. Specify a license key file or enter a license key in accordance with the instructions shown in the messages that appear on the window. If a license key file was stored in step 5, specify that license key file. If a license key file is not used, specify the license key directly.
9. Enter user information in accordance with the instructions shown in the messages that appear on the window.
10. Specify the installation folder in accordance with the instructions shown in the messages that appear on the window.
11. The utility for registering HDLM persistent reservation keys (`dlmprsvkey`) is automatically executed to create a PRSV key. The PRSV key is required for the HDLM functions to operate normally. Also, the value of the PRSV key must be unique among hosts. Creation of the PRSV key may be unsuccessful if, for example, an NIC does not exist. Do one of the following in accordance with the result of the execution of the `dlmprsvkey` utility:
    - If the key creation is successful, the created PRSV key appears in the dialog box. If you do not need to change the value, click the **Next** button. If you must change the value because another host already has the same PRSV key, change the value, and then click the **Next** button. If you want to undo the change, click the **Back** button and then start over from step 10.
    - If the creation is unsuccessful, a dialog box appears that prompts you for the PRSV key. Enter the PRSV key, and then click the **OK** button.

    For the values you can specify for the PRSV key, follow the instructions shown in the installation program window.
12. The program checks the PRSV key. If the KAPL09128-W message appears, follow the procedure below:
    - You are prompted to re-enter the PRSV key. Enter an appropriate PRSV key. The program then checks the PRSV key again.
    - If no message appears, go to the next step.
13. The message **Select Storage System to be managed.** is displayed: click the **Next** button. In an Oracle RAC environment, the EMC DMX series and EMC CX series cannot be set as an HDLM management-target device. Thus, do not select **EMC Symmetrix DMX Series, CLARiiON CX Series**. Similarly, the HP EVA series cannot be set as an HDLM management-target device. Accordingly, do not select **HP StorageWorks EVA Series** either.
14. Follow the instructions shown in the messages that appear on the window.
    - If a dialog box that begins with the following sentence appears during installation, and the Storport Miniport driver is used as the HBA driver, stop the HDLM installation. Then, install QFE838894 or a later version of the Microsoft Storport driver, or install Windows Server 2003 SP1 or later.

      Notes on using a Storport Miniport driver:

      Read these notes before using a Storport Miniport driver as an HBA driver.

      The file version of the Storport.sys of this system (Microsoft Storport driver) is n.n.nnnn.n.

When using a Storport Miniport driver as an HBA driver:

Please update the Storport Miniport driver to a Storport.sys with a file version n.n.nnnn.n or later.

- The PRSV key is registered before the installation finishes. If the KAPL09131-W message appears, follow the procedure described in step 16.

15. Check the results of the installation.

    If you performed an unattended installation, check the installation results in the command prompt.

16. When the installation finishes, execute the `dlmprsvkey` utility with the `-v` parameter specified. Make sure that the PRSV key displayed by the `dlmprsvkey` utility is unique among those of any other hosts in the SAN. If the PRSV key is not unique or is not registered, or if the KAPL09131-W message appears, execute the `dlmprsvkey` utility with the `-r` parameter specified to re-register the PRSV key. If the PRSV key is not registered, the HDLM functions may not operate normally. For details about the `dlmprsvkey` utility, see section 8.4.

    If you used the license key file, it will be deleted when the installation finishes. The KAPL09115-W message appears if deletion of this file fails. In this case, delete the file manually, such as by using Explorer.

17. Shut down the host. Leave the host in a single-path configuration until you check (in step 25) whether HDLM has been successfully installed.

18. On all the hosts comprising the cluster system, perform steps 3 through 17.

19. Make sure that all the hosts comprising cluster system have been completely shut down.

20. Start the host individually.

21. Log on to the Windows system again as a member of the administrators group.

22. Execute the `dlnkmgr` command's `view` operation to display the status of each program.

    An example of executing the `dlnkmgr` command's `view` operation is as follows:

```
>dlnkmgr view -sys
HDLM Version               : xx-xx
Service Pack Version       :
Load Balance               : on(rr)
Support Cluster            : off
Elog Level                 : 3
Elog File Size (KB)        : 9900
Number Of Elog Files       : 2
Trace Level                : 0
Trace File Size(KB)        : 1000
Number Of Trace Files      : 4
Path Health Checking       : on(30)
Auto Failback              : off
Remove LU                  : off
Intermittent Error Monitor : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

23. Use the results of the dlnkmgr command's view operation to check the version of the installed HDLM. When `05-91` is displayed in `HDLM Version`, the correct version of HDLM has been installed.

24. Use the results of the `dlnkmgr` command's `view` operation to check that the programs are running properly. If `HDLM Manager`, `HDLM Alert Driver`, and `HDLM Driver` are all Alive, all programs are running correctly.

25. After installation finishes, check the path information as described in section 3.7, and make sure that you have successfully installed HDLM in a single-path configuration.

26. Connect cables with all HBAs (multi-path configuration).

27. Check the path information as described in section 3.7 to make sure that you have successfully built a multi-path configuration.

28. Shut down the host.

29. On all the hosts making up the cluster system, perform the operations from step 18 to step 27.

30. Install and configure Oracle RAC.

    The following conditions are satisfied, you must change the settings for Oracle RAC 10g after building the environment.

    - Release of 10.1.0.3.0 or later of Oracle RAC 10g is being used.
    - A host and a voting disk are connected by multiple paths (in a multi-path configuration) in an FC-SAN environment.

    For details, see section 3.3.

31. Make sure that the program is working normally, by examining the results of the `dlnkmgr` command's `view` operation.

    An example of executing the `dlnkmgr` command's `view` operation is as follows:

```
>dlnkmgr view -sys
HDLM Version                : xx-xx
Service Pack Version        :
Load Balance                : on(rr)
Support Cluster             : off
Elog Level                  : 3
Elog File Size (KB)         : 9900
Number Of Elog Files        : 2
Trace Level                 : 0
Trace File Size(KB)         : 1000
Number Of Trace Files       : 4
Path Health Checking        : on(30)
Auto Failback               : off
Remove LU                   : off
Intermittent Error Monitor  : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

    Even if you are using Oracle RAC, `off` appears for `Support Cluster`. Regardless, the cluster support function runs normally.

3.6.4 Upgrade Installation or Re-installation of HDLM

You can perform an upgrade installation for HDLM 5.5 or later only. To migrate HDLM 5.4 or earlier to version 5.5 or later, see section 3.6.5.

The procedure for an upgrade installation or re-installation is the same as for a new installation of HDLM, except for the following steps:

- Executing the `dlmchkpath` utility for checking HDLM paths.

  The `dlmchkpath` utility is executed automatically when the installation program (setup.exe) starts. The `dlmchkpath` utility checks whether the system is in a single-path configuration. If a warning dialog box appears, reconfigure the system into a single-path configuration, and then perform the upgrade installation or re-installation again. Note, however, that when an unattended installation is used and the system is determined to be in a multi-path configuration, an HDLM upgrade installation or re-installation will end without displaying any warning dialog boxes.

- Entering the license key.

  The window displays the type and expiration date of the license key, which were entered when HDLM was installed for the first time. If the license key has expired, the procedure is the same as for a new installation.

- Entering user information and specifying the installation folder.

This step is omitted.

- Creating and checking the PRSV key.

  This step is omitted if an appropriate PRSV key exists. In such a case, it is also unnecessary to check for duplicate PRSV keys after the installation finishes.

Upgrade installation or re-installation from HDLM 5.7 or later

- Selecting an HDLM management-target device

  The default of the HDLM management-target device is the same as that before the upgrade installation or re-installation. For example, if you select **EMC Symmetrix DMX Series, CLARiiON CX Series** when you install HDLM, **EMC Symmetrix DMX Series, CLARiiON CX Series** is already selected when it appears in the dialog box.

3.6.5 Migrating from HDLM 5.4 or Earlier to HDLM 5.5 or Later

To upgrade from HDLM 5.4 or earlier:

1. Copy the following file to any place other than the HDLM installation folder.

   `dlmmgr.xml` is the HDLM Manager configuration file. `dlmwebagent.properties` is the configuration file for HDLM Remote Access Interface. `dlmwebagent.properties` exists in HDLM 5.02 or later only. If you migrate to HDLM 5.9.1, you do not need to copy `dlmwebagent.properties`.

   ```
   \HDLM-installation-folder\config\dlmmgr.xml
   \HDLM-installation-folder\config\dlmwebagent.properties
   ```

2. Uninstall HDLM by referring to the manual of HDLM whose version is to be uninstalled.
3. Perform the new installation of HDLM in accordance with the procedure in section 3.6.
4. Copy the file copied in step 1 to the following location to overwrite the existing file:

   ```
   \HDLM-installation-folder\config\dlmmgr.xml
   \HDLM-installation-folder\config\dlmwebagent.properties
   ```

5. Delete the file copied in step 1.
6. Restart the host.

Note:

When you install HDLM 5.5 or later in an environment where HDLM 5.4 or earlier was used, **DLMAlertDriver** is displayed in the **Non-Plug and Play Drivers** area of the **Device Manager** window. You can delete **DLMAlertDriver** by using the procedure below. Note, however, that even if you do not delete **DLMAlertDriver**, HDLM operations will not be affected.

- In **Device Manager** window, in the **View** menu, choose **Show hidden devices**.
- In the **View** menu, choose **Devices by connection**.
- Select **Non-Plug and Play Drivers** to display **DLMAlertDriver**.
- Delete **DLMAlertDriver**.
- Restart the system.

3.6.6 Installing JRE

To start HDLM GUI, an HDLM uses the JRE that is bundled with the HDLM product (JRE 1.3.1 provided by Sun Microsystems, Inc.).

For HDLM version 5.8 or later, a JRE whose version differs from the one bundled with HDLM can be used to start HDLM GUI. (You can use JRE 1.4.2_13 (32 bit), JRE 5.0_05 (32 bit), or JRE 5.0_10 (32 bit), all provided by Sun Microsystems, Inc.)

Note:

When certain conditions are met, a JRE whose version differs from the one bundled with HDLM cannot be used to start HDLM GUI. For details on the conditions, see section 4.2.1.

To install JRE:

1. Download the JRE from the Sun Microsystems website.
2. Install the downloaded JRE on the host where the HDLM has been installed.

   Do not install the JRE directly in *HDLM-installation-folder*\jre_user. If you do this accidentally, uninstall the JRE, and then reinstall it in another folder.
3. To the following folder, copy all the configuration files, including the JRE installation folder.

   ```
   HDLM-installation-folder\jre_user
   ```

Notes:

- If both versions (JRE 1.4.2_13 (32 bit) and JRE 5.0_05 (32 bit)) have been installed in the above folder, HDLM will use JRE 5.0_05 (32 bit).
- If you uninstall HDLM, *HDLM-installation-folder*\jre_user is deleted.

3.7 Checking the Path Configuration

HDLM functionality such as load balancing and failover is only available for HDLM management-target *devices* that have more than one active path. After you install HDLM or change the hardware configuration, check the structure and statuses of these paths.

To check the path information, use the `dlnkmgr` command's `view` operation or use the **Path List** view in the Path Management window of the HDLM GUI. The following subsection shows how to check the path information. For details about the **Path List** view, see section 6.2.4.

How to use the HDLM command's `view` operation to check path information is described below. For details about the `view` operation, see section 7.7.

Specify the `-path` parameter and check the output information:

Execute the following command:

```
>dlnkmgr view -path > redirect-destination-file
```

Open *redirect-destination-file-1* and check the following:

- Make sure that an LU accessed by a path exists.

  A path can be identified with `PathName`. The LU that is accessed by a path can be identified with a combination of `DskName` and `iLU`.

- Make sure that all paths are online.

  Make sure that `PathStatus` is `Online`. If there is a path whose status is not online, `Reduced` will be displayed.

- Make sure that the combinations of the CHA port (`ChaPort`), through which paths access the same LU, and the HBA port (the host port number and bus number displayed in the `PathName` column) are different. (for multipath configurations)

  The two-digit number from the left of the numbers displayed for `PathName` indicates an host port number. The numbers displayed between the period to the right of the host port number and the next period indicate a bus number.

- Make sure that there are different host port numbers and bus numbers for each physical HBA port (for multipath configurations)

If the system cannot be configured in a multi-path configuration, perform the following operations:

- In the Device Manager window of Windows, select **Disk drives** and then click **Scan for hardware changes**.
- In the Disk Management window of Windows, click **Rescan Disks**.

3.8 Setting Up Integrated Traces

When HDLM is used, `dlnkmgr` commands and GUI operation logs are output to the *`integrated trace information files`* of Hitachi Network Objectplaza Trace Library (HNTRLib2) (*`installation-destination-drive`*`:\Program Files\HITACHI\HNTRLib2\spool\Hntr2`*`n`*`.log` files (*`n`* indicates a file number)). In Windows Server 2003 (IPF and x64), replace `Files` with `Program Files (x86)`.

If there is a significant amount of integrated trace information output information may end up deleted in a short amount of time. Also, if a large amount of integrated trace information is output at once, the integrated trace information that overflowed the buffer might not be saved in integrated trace files. To save as much information as possible, change the settings for Hitachi Network Objectplaza Trace Library, increasing the integrated trace file size and buffer size. Note that specifying the values too large places a heavy load on the system. When determining these values, consider these operational tradeoffs.

Table 3.15 shows the default and recommended values for the integrated trace file settings.

Table 3.15 Default and Recommended Values for Integrated Trace File Settings

Setting		Default Value	Recommended Value
Integrated trace file size		256 (KB)	4096 (KB)
Number of integrated trace files		4	8
Buffer size per monitoring interval	Monitoring cycle	10 (seconds)	5 (seconds)
	Buffer size per monitoring interval	64 (KB)	256 (KB)
Number of messages to be output per monitoring interval	Monitoring cycle	0 (seconds)	0 (seconds)
	Number of messages to be output	0	0

If Hitachi Network Objectplaza Trace Library (HNTRLib2) is already installed, the existing settings will be inherited. If you change these settings, keep in mind that they are used by programs other than HDLM. If an earlier Hitachi Network Objectplaza Trace Library (HNTRLib) is already installed, the settings are not inherited.

To change the integrated trace file settings:

1. In **Explorer**, double-click the following file:

   program-installation-destination-drive:\Program Files\HITACHI\HNTRLib2\bin\hntr2utl2.exe

   The Hitachi Network Objectplaza Trace Utility 2 Release 2.0 dialog box shown in Figure 3.5 appears.

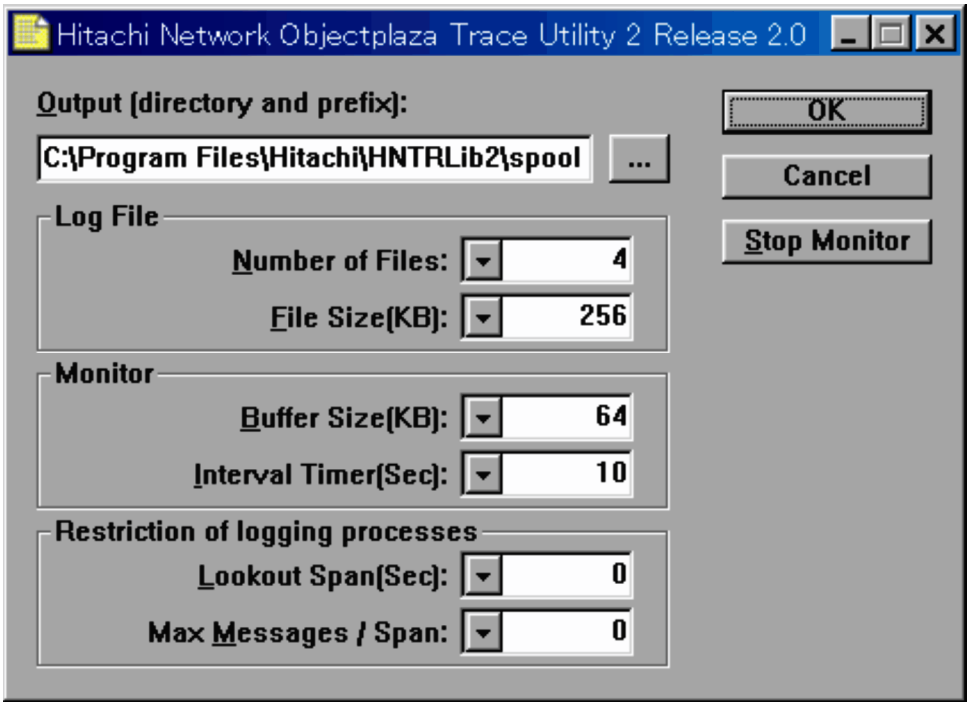


Figure 3.5 Hitachi Network Objectplaza Trace Utility 2 Release 2.0 Dialog Box

2. In **Number of Files**, change the number of integrated trace files. The default is `4`. You can specify a value from 1 to 16. The value you specify here will apply to *n* in *program-installation-destination-drive*:\Program Files\HITACHI\HNTRLib2\spool\Hntr2*n*.log (*n* indicates a file number).

3. In **File Size(KB)**, change the size of an integrated trace file. The default is `256` (kilobytes). You can specify a value from 8 to 8192. Specify a value greater than or equal to the setting of **Buffer Size(KB)**.

4. In **Buffer Size(KB)**, change the buffer size. Change the buffer size for the monitoring cycle. The default is `64` (kilobytes). You can specify a value from 8 to 2048. Specify a value smaller than or equal to the setting of **File Size(KB)**.

5. In **Interval Timer(KB)**, enter a value to shorten the monitoring cycle. The default is `10` (seconds). You can specify a value from 1 to 300.

6. In **Lookout Span(KB)**, enter a value to specify the interval for monitoring the number of messages to be output to the integrated trace file. The default is `0` (seconds). You can specify a value from 0 to 3600. If you specify `0`, you cannot adjust the number of messages to be output because the system ignores the setting of **Max Messages/Span**.
7. In **Max Messages/Span**, enter a value to specify the maximum number of messages to be output to the integrated trace file at the monitoring interval specified in **Lookout Span(KB)**.

   The default is `0`. You can specify a value from 0 to 500.

   If you specify `0`, you cannot adjust the number of messages to be output.

   If you specify `0` for **Lookout Span(KB),** you cannot adjust the number of messages to be output because the system ignores the setting of **Max Messages/Span**.
8. After you finish changing the settings, click the **OK** button. The dialog box closes.
9. Restart the service of Hitachi Network Objectplaza Trace Library. In **Control Panel**, choose **Administrative Tools** and then **Services** to open the Services window. In the list of services, select **Hitachi Network Objectplaza Trace Monitor 2**. Then, from the **Action** menu choose **Restart** to restart the service.

3.9 Uninstalling HDLM

This section explains how to return the operating environment to the way it was before HDLM was installed.

3.9.1 HDLM Uninstall Preparation

Back up the data on the host where HDLM is installed, onto storage media such as tape. Also, if necessary, back up the data on the management target device onto storage media such as tape.

3.9.2 Notes on Uninstalling HDLM

Note the following when uninstalling HDLM:

- Depending on the environment, uninstalling HDLM might take some time. Do not terminate the uninstallation process while a progress bar for uninstallation is displayed. The following is an approximate calculation of the time required for uninstallation:

  (1 x *number-of-connected paths*) seconds #

  #: To uninstall HDLM, you must reconfigure the system to a single-path configuration. The time for doing this does not affect the time required for uninstallation. Since the uninstallation time depends on the value of the maximum number of paths that can be configured in your environment, use this value for an approximate calculation.

- Before uninstalling HDLM 5.5 or later, make sure that no other application is using an HDLM management-target LU.

- Uninstalling HDLM 5.0 or later also uninstalls Hitachi Network Objectplaza Trace Library (HNTRLib2). If, however, any program other than HDLM is using HNTRLib2, only HDLM will be uninstalled. Before uninstalling HNTRLib2, see the relevant manuals and documentation provided for each program to check whether any program is using it. Uninstall HNTRLib2 only when no programs, other than HDLM, are using it. For details on uninstalling HNTRLib2, see section 3.9.4.

- Uninstalling version of HDLM earlier than 5.0 does not uninstall Hitachi Network Objectplaza Trace Library (HNTRLib). Uninstall HNTRLib only when no programs, other than HDLM, are using it. See the relevant manuals and documentation provided for each program to check whether any program is using HNTRLib. For details on uninstalling HNTRLib, see section 3.9.5.

- If you disabled the setting for automatically shortening file and folder names (8.3 format) when you installed HDLM, shortened names might not be generated in the `Intel 32` folder in which the HDLM uninstallation program is stored. Therefore, attempts to uninstall HDLM will fail because the uninstallation program cannot be started. If shortened names are not generated in the `Intel 32` folder, use the steps below to uninstall HDLM:

1. Use the registry editor to determine whether `Intel 32` is included in the `UninstallString` value that is used when uninstalling HDLM. If `Intel 32` is included, shortened names are not generated in the `Intel 32` folder. `UninstallString` is included in the following registry keys:

   For Windows 2000 Server and Windows Server 2003 (IA32):

   ```
   HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Uninstall\{DFF378A1-240E-11D5-8A43-0000E2382F13}
   ```

   For Windows Server 2003 (IPF) and Windows Server 2003 (x64):

   ```
   HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Windows\CurrentVersion\Uninstall\{DFF378A1-240E-11D5-8A43-0000E2382F13}
   ```

2. If the `UninstallString` value includes `Intel 32`, then change `Intel 32` to a folder name that contains 8 single-byte alphanumeric characters.

   The following example shows the output before and after the change when `Ctor.dll` is installed in `C:\Program Files\Common Files\InstallShield\Engine\6\Intel 32`.

   Before the change:

   ```
   RunDll32 C:\PROGRA~1\COMMON~1\INSTAL~1\engine\6\Intel 32\Ctor.dll,LaunchSetup ""C:\Program Files\InstallShield Installation Information\{DFF378A1-240E-11D5-8A43-0000E2382F13}\Setup.exe""  -uninstdlm
   ```

   After the change:

   ```
   RunDll32 C:\PROGRA~1\COMMON~1\INSTAL~1\engine\6\folder-name-with-8-single-byte-alphanumeric-characters\Ctor.dll,LaunchSetup ""C:\Program Files\InstallShield Installation Information\{DFF378A1-240E-11D5-8A43-0000E2382F13}\Setup.exe""  -uninstdlm
   ```

3. Copy the `Intel 32` folder to the folder described in step 2.
4. Uninstall HDLM according to the procedure described in *Uninstalling HDLM*.
5. Delete the folder you copied in step 3.

- When uninstalling HDLM on a host where a Device Manager Agent 5.0 or later is installed, do not execute any of the following commands of Device Manager Agent during uninstallation. Also, do not uninstall HDLM while executing any of the following Device Manager Agent commands:

  `hbsasrv`, `HiScan`, `hdvmagt_account`, `hdvmagt_schedule`, `hldutil`, `TIC`

3.9.3 Uninstalling HDLM

After HDLM is uninstalled, sometimes the files below remain undeleted. The files will be deleted when you restart the host according to the procedure.

```
HDLM-installation-folder\DLMTools\perfhdlm\provhdlm.dll
HDLM-installation-folder\lib\libdlm.dll
HDLM-installation-folder\lib\hdlmhcc60.dll
```

The default installation folder for HDLM is `C:\Program Files\HITACHI\DynamicLinkManager`.

The following subsections describe how to uninstall HDLM in different environments.

3.9.3.1 Uninstallation Procedure for a Non-Cluster Environment

To uninstall HDLM in a non-cluster environment:

1. Log on to Windows as a member of the administrators group.
2. Stop all the processes and services that use the HDLM management-target paths. This includes any process or service of an application, such as a DBMS, that is using the HDLM management-target path.
3. If the host and the storage system connect via multiple paths, reconfigure it so that only one path connects the host to the storage system (single-path configuration).

   After uninstalling HDLM, if you start the host in a multi-path configuration, which uses more than one path to connect the host to the storage system, the disk contents may become incorrect.

   Figure 3.6 shows a single path configuration and a multi-path configuration.

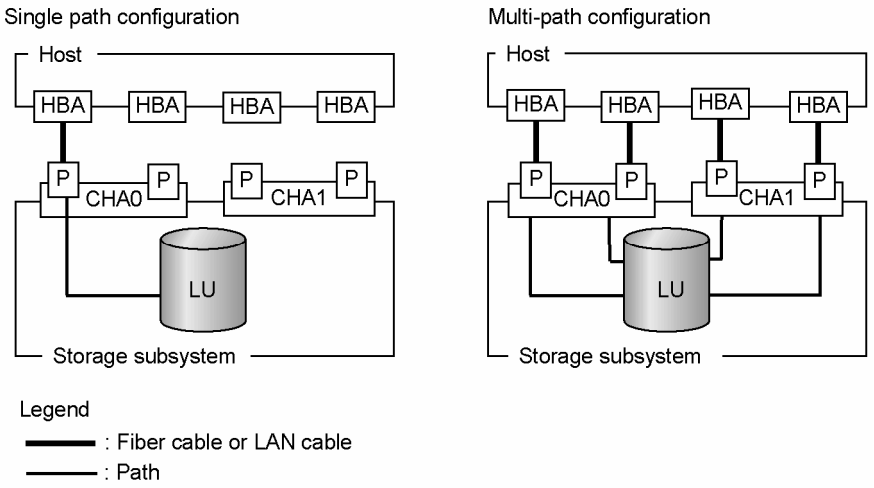


Figure 3.6 Single Path and Multi-Path Configurations

4. Start the uninstallation program. In **Control Panel**, choose **Add/Remove Programs**, and then **Change or Remove Programs**. From the list of programs, select **Dynamic Link Manager**, and click the **Change/Remove** button.
5. The `dlmchkpath` utility is automatically executed. If a warning dialog box appears, follow the procedure below:
   - Cancel the uninstallation. Reconfigure the system into a single-path configuration, and then perform the uninstallation again. For details about the `dlmchkpath` utility, see section 8.5.
   - If a warning dialog box is not displayed, go to the next step.

6. Follow the instructions shown in the messages that appear on the window. If the KAPL09005-E message appears, stop the HDLM manager according to the procedure in section 4.5.2. After stopping the HDLM manager, restart the uninstallation program.
7. When uninstallation finishes, shut down the host.
8. Restart the host.
9. When uninstallation finishes, a dialog box appears prompting you to restart the host.

   Click the **OK** button to restart the host.

3.9.3.2 Uninstallation Procedure for an MSCS or VCS Environment

To uninstall HDLM in an MSCS or VCS environment:

1. Log on to Windows as a member of the administrators group.
2. Stop all the processes and services that use the HDLM management-target paths including any process or service of an application, such as a DBMS, that is using the HDLM management-target path.
3. Stop MSCS or VCS in all the hosts that make up the cluster. When MSCS is used, follow this procedure:

   In **Control Panel**, choose **Administrative Tools** and then **Services**. In the list of services, right-click **Cluster Service.** Then, from the **Action** menu choose **Stop** to stop the service. The message prompting you to restart the system is displayed. In this case, choose **No**.
4. If a host and a storage system connect via multiple paths, reconfigure it so that one path connects one host to the storage system (single-path configuration).

   Uninstalling HDLM in a multi-path configuration, which uses more than one path to connect the host to the storage system, may cause disk contents to be incorrect when the host restarts. Make sure that you uninstall HDLM in the single path configuration.

   Figure 3.7 shows a single path configuration and a multi-path configuration.

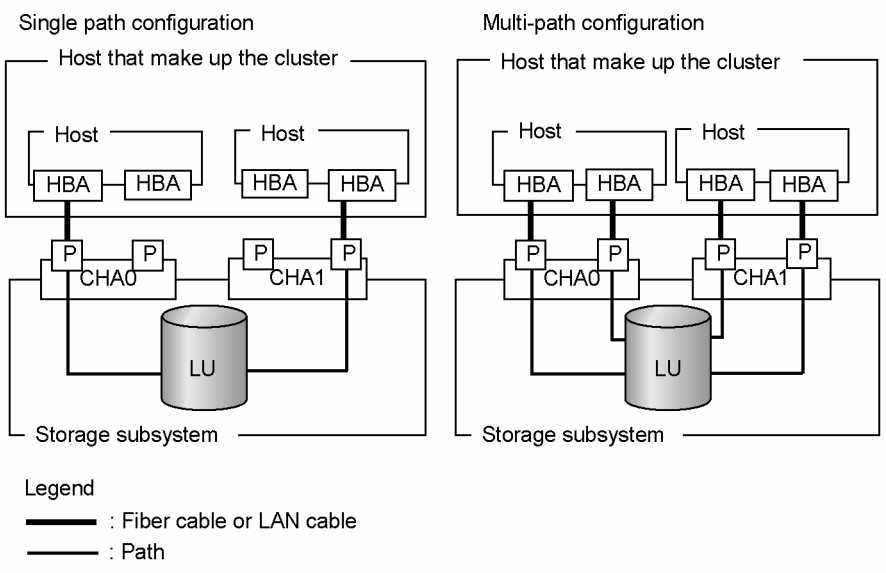


Figure 3.7 Single Path and Multi-Path Configurations

5. Start the uninstallation program. In **Control Panel**, choose **Add/Remove Programs**, and then **Change or Remove Programs**. From the list of programs, select **Dynamic Link Manager**, and click the **Change/Remove** button.
6. The `dlmchkpath` utility is automatically executed. If a warning dialog box appears, follow this procedure:
   - Cancel the uninstallation. Reconfigure the system into a single-path configuration, and then perform the uninstallation again. For details about the `dlmchkpath` utility, see section 8.5.
   - If a warning dialog box is not displayed, go to the next step.
7. Follow the instructions shown in the messages that appear on the window. Uninstall HDLM from all the hosts that make up the cluster. If the KAPL09005-E message appears, stop the HDLM manager according to the procedure in section 4.5.2. After stopping the HDLM manager, restart the uninstallation program.
8. When uninstallation finishes, shut down all the hosts that make up the cluster.
9. Confirm that all hosts are turned off, and are in a single-path configuration.
10. Start each of the hosts that make up the cluster.

3.9.3.3 Uninstallation Procedure for an Oracle RAC Environment

To uninstall HDLM in an Oracle RAC environment:

1. Log on to Windows as a member of the administrators group.
2. Stop the Oracle RAC instance of the host where HDLM is to be uninstalled.

3. If a host and a storage system connect via multiple paths, reconfigure it so that one path connects one host to the storage system (single-path configuration). Uninstalling HDLM in a multi-path configuration, which uses more than one path to connect the host to the storage system, may cause disk contents to be incorrect when the host restarts. Make sure that you uninstall HDLM in the single path configuration.

   Figure 3.7 shows a single path configuration and a multi-path configuration.

4. Start the uninstallation program. In **Control Panel**, choose **Add/Remove Programs**, and then **Change or Remove Programs**. From the list of programs, select **Dynamic Link Manager**, and click the **Change/Remove** button.

5. The `dlmchkpath` utility is automatically executed. If a warning dialog box appears, follow this procedure:

   - Cancel the uninstallation. Reconfigure the system into a single-path configuration, and then perform the uninstallation again. For details about the `dlmchkpath` utility, see section 8.5.
   - If a warning dialog box is not displayed, go to the next step.

6. Follow the instructions shown in the messages that appear on the window. If the KAPL09005-E message appears, stop the HDLM manager according to the procedure in section 4.5.2. After stopping the HDLM manager, restart the uninstallation program.

7. After uninstallation finishes, restart the host.

8. Start the Oracle RAC instance of the host.

9. On all the hosts comprising the cluster system, perform steps 1 through 8.

10. When using release 10.1.0.3.0 or later of Oracle RAC 10g, the value set in the `MISSCOUNT` parameter, for which the threshold of the I/O timeout of the voting disk is set, must be returned to the value that was set before HDLM was installed. For details on how to set the value of the `MISSCOUNT` parameter, contact the company with which you have a support service contract for Oracle.

3.9.4 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib2)

When you uninstall HDLM, if the KAPL09019-E or KAPL09020-E message is output, follow these steps below to uninstall HNTRLib2.

1. Log on to Windows as a member of the administrators group.
2. Start the uninstallation program. In **Control Panel**, choose **Add/Remove Programs**, and then **Change or Remove Programs**. From the list of programs, select **Hitachi Network Objectplaza Trace Library 2**, and click the **Change/Remove** button.
3. Follow the instructions shown in the messages that appear on the window.
4. After uninstallation finishes, restart the host.

Notes:

- If HNTRLib2 is being used by another program, HNTRLib2 will not be uninstalled, and a message will appear.

  If HNTRLib2 was not uninstalled, execute the following command to check the programs that are using it:

  ```
  c:\Program Files\HITACHI\HNTRLib2\bin\hntr2getname.exe
  ```

  If you are unable to complete uninstallation even though no programs other than HDLM are using HNTRLib2, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.
- If the log output directory set in HNTRLib2 was not the default directory, the log files will not be deleted during uninstallation. In this case, delete these files after uninstallation.
- For Windows 2000 Server or Windows Server 2003 (IA32), uninstalling HDLM does not delete the HNTRLib2 common library `hntr2t.dll` file. Even if this file remains undeleted, other applications are not affected. If you want to delete this file, perform the following procedure:
  - Start the registry editor (`regedit.exe`) and check that the following registry key does not exist:

    ```
    HKEY_LOCAL_MACHINE\SOFTWARE\HITACHI\COMMON_DLL\HNTRLIB2
    ```

    If this key exists, it means another application is using the `hntr2t.dll` file. In this case, do not delete the `hntr2t.dll` file.
  - Open the folder specified in the value of the following registry:

    ```
    HKEY_LOCAL_MACHINE\SOFTWARE\HITACHI\COMMON_DLL\PathName\Path00
    ```

    The default is `C:\Program Files\Common Files\Hitachi`.
  - Check that the `hntr2t.dll` file exists and the `hntr2sys.dll` and `hntr2tj.dll` files do not exist in the folder, and then delete the `hntr2t.dll` file.

3.9.5 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib)

After you uninstall HDLM version 4.0 or earlier, if no applications other than HDLM are using HNTRLib, uninstall it using this procedure:

1. Check that no applications other than HDLM are using HNTRLib. See the manuals and documentation for each program to check whether the program is using Hitachi Network Objectplaza Trace Library.
2. Log on to Windows as a member of the administrators group.
3. Start the uninstallation program. In **Control Panel**, choose **Add/Remove Programs**, and then **Change or Remove Programs**. From the list of programs, select **Hitachi Network Objectplaza Trace Library**, and click the **Change/Remove** button.
4. Hitachi Network Objectplaza Trace Utility starts. Select **Unsetup**, and then follow the instructions shown in the messages that appear on the window to execute uninstallation.
5. After uninstallation finishes, restart the host.

Notes:

- If the HNTRLib log output directory is not the default directory, the log files will not be deleted during uninstallation. In this case delete these files after uninstallation.
- Even if you attempt to uninstall HNTRLib2 when HNTRLib is installed, HNTRLib will not be uninstalled. If no other programs are using HNTRLib, delete it manually.

3.9.6 Clearing the Persistent Reservation

If the persistent reservation remains in an LU after HDLM is uninstalled, use the utility for clearing HDLM persistent reservations (`dlmpr`) to clear the persistent reservation. However, the persistent reservation is not left in the LU when you uninstall HDLM as instructed by the procedure in the manual.

For details about how to clear the persistent reservation in the LU, see section 8.3.

Notes:

Persistent reservation remains in the LU If HDLM is uninstalled in one of the following situations, the persistent reservation in the LU remains:

- When MSCS or VCS is running
- When the cable is not connected to the host

To uninstall HDLM, follow the procedure in section 3.9.3.2.

Chapter 4 HDLM Operation

This chapter describes operating procedures for HDLM, including how to operate HDLM and the HDLM manager, and how to change the configuration of the operating environment. Operating procedures are broken down into the following sections:

- Notes on Using HDLM (see section 4.1)
- HDLM operations using the HDLM GUI (see section 4.2)
- Using Commands for HDLM Operations (see section 4.3)
- Using the Windows Administrative Tool to Check Path Information (see section 4.4)
- Starting and Stopping the HDLM Manager (see section 4.5)
- Reconfiguring the HDLM operating environment (see section 4.6)

4.1 Notes on Using HDLM

This section provides notes on HDLM operation.

4.1.1 Using a Storage Management Program

You must not change the vendor and product IDs of the storage system. If you change them, HDLM cannot recognize the storage system.

4.1.2 Upgrading Windows

Before upgrading the OS from Windows 2000 Server to Windows Server 2003 or re-installing the OS during system recovery, always uninstall HDLM. After upgrading the OS, install the appropriate HDLM version for the upgraded OS.

4.1.3 Using MSCS

4.1.3.1 When the Number of Displayed Paths is Less Than the Actual Number of Paths

When displaying path information, the number of paths displayed might be less than the actual number of paths. This occurs when one host uses an LU exclusively, preventing other hosts from obtaining information about the devices in that LU. When this is resolved and the information can be obtained, the host can display all paths.

4.1.3.2 When a System Event Occurs in the MSCS Environment

When you start a standby node, or when a standby node has recovered from a path error, the following event is issued and output to the system event log. However, you can still perform operations as usual.

```
Source: mpio
Event ID: 20
Description: A Path Verification request to a device on \Device\MPIODiskn that is
controlled by Hdlm Device-Specific Module has failed. This may indicate a Path Failure.
```

This event occurs when MPIO checks the disk before initializing it and the standby node cannot use the LU because the active node is using it.

4.1.4 Using the EMC DMX series, EMC CX Series, and HP EVA series

Only HDLM version 5.7 or later can manage the EMC DMX series or EMC CX series. For HDLM versions earlier than 5.7, see section 3.6.4 and then perform an update installation.

Only HDLM version 5.9.1 or later can manage the HP EVA series. For HDLM versions earlier than 5.9.1, see section 3.6.4 and then perform an update installation.

You can display and operate the HDLM GUI windows for the Thunder 9200/9500V series, Lightning 9900/9900V series TagmaStore, and Universal Storage Platform V. If you specify the EMC DMX series, EMC CX series, or HP EVA series as an HDLM management-target device, use HDLM commands to display information and set the operating environment. For details about each command, see Chapter 7.

When using EMC CX Series, connect only one port of the storage to the switch in a single-path configuration and connect the switch to the server in a multi-path configuration.

4.1.5 Notes on Using Veritas Backup Exec for Windows and the Veritas NetBackup Intelligent Disaster Recovery Facility

When you use Veritas Backup Exec for Windows and the Veritas NetBackup Intelligent Disaster Recovery facility, the following might occur:

- If all paths experience a failure and Windows recognizes some or all paths, the disk numbers might have changed from those that were in effect when the host started up. In that case, restarting the host restores the original disk numbers. Restore the original disk numbers, and then use Veritas Backup Exec for Windows or the Veritas NetBackup Intelligent Disaster Recovery facility.
- Restoring the Windows 2000 Server system requires that the host be restarted twice.
- If you restore Windows Server 2003, the `STOP:c0000135` error message appears and the system stops. In that case, restart the host. If restoration of Windows Management Instrumentation information fails, the HDLM performance monitor can no longer be used. In that case, re-install HDLM.

4.2 HDLM Operations Using the HDLM GUI

This chapter explains the procedures for operating HDLM GUI window components. For details on the components of each window, see section 6.1.

4.2.1 Notes on Operating HDLM GUI Windows

This section provides important notes for operating HDLM GUI windows.

The HDLM GUI cannot start when all of the following conditions exist:

- The operating system of the host is Windows Server 2003 with SP1 or later applied.
- Data Execution Prevention (DEP) functionality is enabled on the host.
- HDLM GUI is started by using the JRE that is bundled with the HDLM product (JRE 1.3.1 provided by Sun Microsystems, Inc.) on the host.

When all of the following conditions exist, exclude the Java Runtime Environment that HDLM GUI is using from being subject to DEP (data execution prevention), by performing the following procedure:

1. Choose **Start**, **Settings, Control Panel**, double-click **System.** The **System Properties** window is displayed.
2. Select the **Advanced** tab. Click the **Settings** button under **Performance**. The **Performance Option** window is displayed.
3. Select the **Data Execution Prevention** tab.
4. Select the check box beside **java**. If **java** is not displayed add it by clicking the **Add** button and then specify the following file in the File Selection dialog box:

   HDLM-installation-folder\jre\bin\java.exe.

   Clicking **Open** button then adds **java**.
5. Complete the process by clicking the [OK] button. The Java Runtime Environment the HDLM GUI is using is excluded from being subject to DEP (data execution prevention).

- If you do not install SP1 or later on Windows Server 2003 (IPF), the HDLM GUI might end abnormally when you start or operate the HDLM GUI. If this problem occurs, change the link destination of the shortcut for starting the HDLM GUI as shown below:
  - Before changing the link destination

    "*HDLM-installation-folder*\bin\dlmgui_launcher.exe"
  - After changing the link destination

    "*HDLM-installation-folder*\jre\bin\javaw.exe" -Xint -classpath "*system-drive-name*:\Program Files(x86)\HITACHI\HNTRLib2\classes\hntrlib2j.jar;*HDLM-installation-folder*\bin\DLMLocal.jar" dlmgui.DLMGUI

    Note that if you change the link destination of the shortcut, the following phenomena occurs:
    - The HDLM GUI will take 1.5 times longer to start.

– The JRE that is bundled with the HDLM product (JRE 1.3.1 provided by Sun Microsystems, Inc.) will be used to start the HDLM GUI, even if you install a JRE whose version differs from the one bundled with HDLM.

When the HDLM GUI ends abnormally, the message below is output to the Windows application event log. Note that the value for `fault address` might differ from 0x0004d87d.

```
Reporting queued error: faulting application java.exe, version 0.0.0.0, faulting module
jvm.dll, version 0.0.0.0, faulting address 0x0004d87d.
```

- If, in HDLM 5.8 or later, you use the HDLM GUI shortcut that was copied when an earlier version of HDLM was being used, the following phenomenon occurs:

  The HDLM GUI will be started by using the JRE that is bundled with the HDLM product (JRE 1.3.1 provided by Sun Microsystems, Inc.), even if you install a JRE whose version differs from the one bundled with HDLM. In this case, check the following notes contained in HDLM *Release Notes* for the copy source version:

  – Notes when HDLM GUI cannot be started because the Data Execution Prevention (DEP) feature in Windows Server 2003 SP1 or later is enabled.

  – Notes when SP1 or later is not applied to Windows Server 2003 (IPF) and HDLM GUI ends abnormally when it is being started or while it is running.

- When the focus is on an object such as a button, the **Enter** key does not function as an operation, in the path management window or dialog box. Please use the **Space** key or click with the mouse to perform an operation in the window or dialog box.
- When the HDLM GUI is running for an extended period of time, response time might increase. In such a case, restart the HDLM GUI.
- When the focus is on the **Status** check box, the frame indicating the focus is not displayed, but you can perform operations.
- If you reconfigured an HDLM management-target device while the HDLM GUI was displayed, refresh the HDLM GUI.

- If the I/O load on the dynamic disk is heavy, it might take a long time to redisplay the HDLM GUI.
- When an operation to close a window is performed in the window frame of the path management window, the HDLM GUI will terminate even if the Option window remains open.
- If the HDLM GUI screen size is reduced, in some cases, buttons such as the **Online** and **Offline** buttons may become hidden. In such cases, please adjust the screen size appropriately, so that the buttons are visible.
- If you open multiple Path Management windows, the only logs output into the HDLM GUI log files (`dlmgui`*`n`*`.log`, where *n* indicates a file number) will be those pertaining to the first-opened window. The logs pertaining to other Path Management windows are output to the integrated trace information file of the Hitachi Network Objectplaza Trace Library (*`installation-destination-drive`*`:\Program Files`#`\HITACHI\HNTRLib2\spool\Hntr2`*`n`*`.log`, where *n* indicates a file number).

  #: In the Windows Server 2003(IPF and x64), replace this part with Program Files (`x86`).
- If you are using Universal Storage Platform V, the **Configuration** view is not displayed. In the view frame, the `KAPL02087-I` message is displayed. The following buttons and check boxes for the **Configuration** view are not displayed:
  - **Online** button
  - **Offline** button
  - **Type** check box
  - **Status** check box

4.2.2 Displaying or Closing the Path Management Window

This section explains how to display or close the Path Management window of HDLM GUI.

4.2.2.1 Displaying the Path Management Window

To display the Path Management window:

1. Log on to Windows as a member of administrators group.

   The Path Management window cannot be displayed if you logged on to Windows as a user other than a member of the administrators group.
2. From the **Start** menu, select **Programs**, **Dynamic Link Manager**, and then **HDLM GUI**. The **Path List** view of the Path Management window is displayed.

4.2.2.2 Closing the Path Management Window

To close the Path Management window of the HDLM GUI, click the Exit button. The Path Management window will usually close. Note, however, that the Path Management window cannot be closed if the Options window is open. If the Options window is open, you must first close that window and then close the Path Management window.

4.2.3 Viewing Path Information

This section explains how to view path information. Path information can be displayed in the following two formats:

- Configuration-diagram format. This format uses a diagram to display the configuration of the host, host bus adapters, paths, channel adapters, LUs, and storage system.
- List format. This format displays path information in a list.

You can switch the display format for the path information by clicking the Configuration tab or the Path List tab.

The following subsection explains how to view the path information in each format.

4.2.3.1 Viewing Path Information in Configuration-Diagram Format

To view the path information in the configuration-diagram format:

1. Display the Path Management window. The **Path List** view of the Path Management window is displayed. For details on displaying the Path Management window, see section 4.2.2.1.
2. In the tree frame, select the storage system or the LU connected to the path whose information you want to view. If a storage system is selected, information on the paths that connect the host and the selected storage system is displayed as a diagram in the view frame.
3. Click the **Configuration** tab.

   The **Configuration** view is displayed in the view frame.

   If an LU is selected, information on the paths that connect the host and the selected LU is displayed as a diagram in the view frame. Note that the paths to be displayed in the **Configuration** view can be restricted or expanded using the **Type** and **Status** check boxes in the view frame. For details on the tree frame, see section 6.2.2. For details on the **Configuration** view in the view frame, see section 6.2.3.

4.2.3.2 Viewing Path Information in List Format

To view path information in the list format:

1. Display the Path Management window. The **Path List** view of the Path Management window is displayed. (For details on displaying the Path Management window, see section 4.2.2.1.)
2. In the tree frame, select the host, storage system, or LU connected to the path whose information you want to view.

   If a host is selected, information on all the paths connected to the host is displayed in a list in the view frame. Note that the paths to be displayed in the **Path List** view can be restricted or expanded using the **Type** and **Status** check boxes in the view frame. For details on the tree frame, see section 6.2.2. For details on the **Path List** view in the view frame, see section 6.2.4.

4.2.4 Exporting Path Information to a CSV File

Exporting path information, which is displayed in the Path List view, to a CSV file is useful when you want to display, edit, or print out path information using other applications.

4.2.4.1 Notes on Exporting Path Information to a CSV File from the Host

When path information is output to the CSV file on the host, the CSV Output dialog box is displayed. Note the following when using the dialog box:

- The toolbar items for **List** or **Details** at the top right part of the **Export CSV** dialog box do not function as alternate views. The files and folders in the list box are always displayed in List mode.
- You cannot use the **Delete** key to delete the files and folders in the list box. If you want to delete them, use the command line.
- When you want to open a displayed folder, double-click it. You cannot open a folder by selecting it and pressing the **Space** key.
- When you add a new folder by using the toolbar item **Create New Folder**, the **Export CSV** dialog box creates the new folder in the bottom of the list box. If there are too many folders and files in the list box, the new folder cannot be displayed. If you want to display the new folder, scroll down the list.
- In the list box, you can rename a folder or file by right-clicking it. If a folder or file is renamed, make sure that you confirm the change by pressing the **Enter** key. If you select another folder or file without confirming the renaming of the file or folder, the renaming is canceled.
- Do not reduce the size of the **Export CSV** dialog box. If you reduce the size of the dialog box, the File of type text field and the File name pull-down list will become inaccessible.

4.2.4.2 Exporting Path Information to a CSV File

To export path information to a CSV file:

1. Display the Path Management window. The **Path List** view of the Path Management window is displayed. (For details on displaying the Path Management window, see section 4.2.2.1.)
2. By performing operations in the tree frame, make sure that the **Path List** view displays the path whose information is to be exported to a CSV file. (For details on the tree frame, see section 6.2.2.)

   Note that the paths to be displayed in the **Path List** view can be restricted or expanded using the **Type** and **Status** check boxes in the view frame.
3. Click the **Export CSV** button. A dialog box for specifying the name for the exported CSV file is displayed. The default file path is *home-directory*/pathlist.csv.

   For detailed notes on using the dialog box that is displayed when you output path information to a CSV file from a host, see section 4.2.4.1.
4. Specify the CSV file name, and then click the **Save** button. The dialog box for specifying the file name closes and the information displayed in the **Path List** view will be exported to the CSV file.

4.2.5 Setting Path Statistics to Initial Value

This section explains how to set the values of the path statistics (I/O count and I/O errors) to the initial value (0) for all the paths that HDLM manages. This operation is useful when you want to find out how many I/Os or I/O errors occur during a specific period, from the time when the values for I/O count and I/O errors are set to the initial value (0).

To set the path statistics to zero:

1. Display the Path Management window. The **Path List** view of the Path Management window is displayed. (For details on how to display the Path Management window, see section 4.2.2.1.)
2. Click the **Clear Data** button. The value displayed in **I/O Count** and in **I/O Errors** will be set to the initial value (0) for all paths that HDLM manages.

4.2.6 Changing the Path Status

The procedure for changing the path status differs depending on the display format of the path information. Path information can be displayed in the following two formats:

- Configuration-diagram format. This format uses a diagram to display the configuration of the host, host bus adapters, paths, channel adapters, LUs, and storage system.
- List format. This format displays path information in a list.

You can switch the display format for the path information by clicking the Configuration tab or the Path List tab.

4.2.6.1 Changing the Path Status from the Configuration Diagram

To change the path status when path information is displayed in configuration-diagram format:

1. Display the Path Management window. The **Path List** view of the Path Management window is displayed. (For details on displaying the Path Management window, see section 4.2.2.1.)
2. Click the **Configuration** tab.

   The **Configuration** view is displayed in the view frame.
3. In the tree frame, select the storage system or the LU connected to the path whose status you want to change. If a storage system is selected, information on the paths that connect the host and the selected storage system is displayed as a diagram in the view frame. If an LU is selected, information on the paths that connect the host and the selected LU is displayed as a diagram in the view frame. Note that the paths to be displayed in the **Configuration** view can be restricted or expanded using the **Type** and **Status** check boxes in the view frame. For details on the tree frame, see section 6.2.2. For details on the **Configuration** view in the view frame, see section 6.2.3.
4. Select the path whose status you want to change. The line of the selected path will become thick. You can select a path by any of the following three actions:
   - Click the path. The selected path will become the target of operations.
   - Click the CHA button. All paths connected to the channel adapter that corresponds to the clicked CHA button will become the targets of operations.
   - Click the button for the HBA port. The path connected to the HBA port that corresponds to the clicked HBA port will become the targets of operations.
4. If you want to change the status of the selected path to online, click the **Online** button. If you want to change the status to offline, click the **Offline** button. A dialog box confirming that you want to change the status is displayed.
5. Click the **OK** button. The status of the selected path changes, and the line indicating the path status changes also. For details on displaying the path, see section 6.2.3.

   If you click the **Online** button without first selecting a path, in the **Path List** view all the paths whose statuses are not `Online` will change to `Online`. Also note that if no path is selected, the **Offline** button will be displayed as inactive, and will not function.

If you attempt to change the status of multiple paths but the status of one of those paths cannot be changed, the KAPL02022-W or KAPL02023-W message appears. To ignore the path whose status cannot be changed and to continue processing, click the **OK** button. To stop processing, click the **Cancel** button.

4.2.6.2 Changing the Path Status from the List Format

To change the path status when path information is displayed in list format:

1. Display the Path Management window. The **Path List** view of the Path Management window is displayed.
2. In the tree frame, select the host, storage system, or LU connected to the path whose status you want to change.

   If a host is selected, information on all paths connected to the host is displayed in a list in the view frame. If a storage system is selected, information on the paths that connect the host and the selected storage system is displayed in a list in the view frame. If an LU is selected, information on the paths that connect the host and the selected LU is displayed in a list in the view frame. Note that the paths to be displayed in the **Path List** view can be restricted or expanded using the **Type** and **Status** check boxes in the view frame. For details on the tree frame, see section 6.2.2. For details on the **Path List** view in the view frame, see section 6.2.4.
3. Select the path whose status you want to change. To select paths on which you want to perform an operation, use any of the following methods:
   - To select one line only, you can click the line that displays the information for the path you want to perform an operation on.
   - To select a range of lines, you can click the top and the bottom lines of the desired range while pressing the **Shift** key.
   - To select a range of lines, you can drag the mouse over the lines.

     Note that some paths might remain unselected depending on the speed of your mouse drag.
   - To select multiple lines, you can click desired lines while pressing the **Ctrl** key.

   To release selection of a path or paths, use either of the following methods:
   - To release all selected lines, click an empty line.
   - To release the selection of one line, click the line while pressing the **Ctrl** key.
4. If you want to change the status of the selected path to online, click the **Online** button. If you want to change the status to offline, click the **Offline** button. A dialog box confirming that you want to change the status is displayed.

5. Click the **OK** button. The status of the selected path changes to online or offline. Also, the icons displayed in the **Status** column change to  (**Online** status) or  (**Offline(C)** status). In a cluster configuration, if a user uses the Path Management window or uses the `dlnkmgr` command's `offline` operation to perform offline operations during reserve processing, the offline processing waits until the reserve processing finishes. During this wait, the path status is **Online(P)** rather than **Offline(C)**; however, the icon remains as  . After the reserve processing finishes and the offline operations execute, the path status will switch to **Offline(C)**; however, the icon will not automatically switch to  . To display the most recent path status, click the **Refresh** button.

   If you click the **Online** button without first selecting a line or if you select a line that has no information displayed, in the **Path List** view all the paths whose statuses are not **Online** will change to online. Also note that if no path is selected, the **Offline** button will be displayed as inactive, and will not function.

   If you attempt to change the status of multiple paths but the status of one of those paths cannot be changed, the KAPL02022-W or the KAPL02023-W message appears. To ignore the path whose status cannot be changed and to continue processing, click the **OK** button. To stop processing, click the **Cancel** button.

4.2.7 Refreshing Path Information

To refresh the path information displayed in the Path Management window, click the Refresh button in the Path Management window. The most recent path information is displayed in the tree frame and the view frame of the Path Management window.

4.2.8 Viewing or Setting Up the Operating Environment

To view or change the operating environment for HDLM:

1. Display the Path Management window. The **Path List** view of the Path Management window is displayed.
2. Click the **Options** button. The most recent operating environment for HDLM is displayed in the Options window.

   For details on items displayed in the Options window, see section 6.3.
3. If necessary, change the settings in the Options window.
4. Click the **Apply** button or the **OK** button to make the changes take effect. The settings made in the Options window will take effect and the Options window closes. Note that if you click the **Cancel** button to close the Options window before clicking the **Apply** button to make the changes take effect, the changed settings will have no effect.
5. Click the **Cancel** button. Alternatively, click the icon in the top left of the Path Management window (next to the window title), and from the menu that appears, choose **Close** the Path Management window. (This step is unnecessary if you clicked the **OK** button in step 4 and the Options window is already closed.)

4.2.9 Viewing the HTML Manual

To view the HTML version of this manual (*HiCommand Dynamic Link Manager User's Guide (for Windows(R))*:

1. Display the Path Management window.

   The **Path List** view of the Path Management window is displayed.

   For details on displaying the Path Management window, see sections 4.2.2.1.

2. Click the **Help** button.

   Your default Web browser starts and opens the Help window for the HTML version of this manual.

4.2.10 Using the HDLM GUI to Perform the Same Operations as Commands

You can use the HDLM GUI windows to perform the same operations as you would perform using the HDLM commands (see Table 4.1). You can also use the HDLM windows together with HDLM commands to operate HDLM. For example, when you execute an HDLM command, you can check the results in the HDLM windows. Likewise, when you operate HDLM using the HDLM windows, you can check the results by executing the dlnkmgr view command.

Table 4.1 Correspondence Between HDLM Commands and HDLM GUI

HDLM Command	HDLM GUI
dlnkmgr clear	**Clear Data** button on the **Path List** tab of Path Management window
dlnkmgr help	Help window
dlnkmgr online	**Online** button on the Path Management window
dlnkmgr offline	**Offline** button on the Path Management window
dlnkmgr set	Options window
dlnkmgr view	Path Management window and Options window
—	**Export CSV** button on the **Path List** tab of Path Management window

4.3 Using Commands for HDLM Operations

The following subsections explain how to use the HDLM commands to utilize HDLM functions.

4.3.1 Notes on Using Commands

- Execute the command as a member of the administrators group.
- To specify a value containing a space in a parameter, enclose the entire value in double quotation marks (").
- If the I/O load on the dynamic disk is heavy, it might take a long time to execute the `view` operation.

4.3.2 Viewing Path Information

To display path information, execute the `dlnkmgr` command's `view` operation with the `-path` parameter specified. The following example shows how to execute the command:

```
dlnkmgr view -path
```

```
>dlnkmgr view -path
Paths:000016 OnlinePaths:000016
PathStatus   IO-Count    IO-Errors
Online       1199        0

PathID PathName                        DskName                                  iLU
ChaPort Status     Type IO-Count   IO-Errors  DNum HDevName
000000 0002.0000.0000000000000000.000B EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -           131          0    0 L
000001 0002.0000.0000000000000000.000C EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -           132          0    0 M
000002 0002.0000.0000000000000000.000D EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -           131          0    0 N
000003 0002.0000.0000000000000000.000E EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -           133          0    0 O
000004 0002.0000.0000000000000001.0000 DGC     .RAID 10         .-              6006016099C50...
-       Online     -           203          0    0 F
000005 0002.0000.0000000000000001.0001 DGC     .RAID 5          .-              6006016099C50...
-       Online     -           174          0    0 G
000006 0002.0000.0000000000000002.0000 HITACHI .DF600F          .0329           0000
0A      Online     Own         138          0    0 P
000007 0002.0000.0000000000000002.0001 HITACHI .DF600F          .0329           0001
0A      Online     Non           0          0    0 Q
000008 0003.0000.0000000000000000.0000 DGC     .RAID 10         .-              6006016099C50...
-       Online     -             0          0    0 F
000009 0003.0000.0000000000000000.0001 DGC     .RAID 5          .-              6006016099C50...
-       Online     -             0          0    0 G
000010 0003.0000.0000000000000001.0000 EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -             4          0    0 L
000011 0003.0000.0000000000000001.0001 EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -             5          0    0 M
000012 0003.0000.0000000000000001.0002 EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -             4          0    0 N
000013 0003.0000.0000000000000001.0003 EMC     .SYMMETRIX       .-              6006048000018...
-       Online     -             6          0    0 O
000014 0003.0000.0000000000000002.0000 HITACHI .DF600F          .0329           0000
1A      Online     Non           0          0    0 P
000015 0003.0000.0000000000000002.0001 HITACHI .DF600F          .0329           0001
1A      Online     Own         138          0    0 Q
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
>
```

For details on the displayed items and their descriptions, see section 7.7.

4.3.3 Changing the Status of Paths

This subsection explains how to change the status of paths.

4.3.3.1 Changing the Status of a Path to Online

To change the status of a path to online:

1. Check the current status of the path. To change the status of the path for each HBA port, channel adapter port, or path to online, check the path name or AutoPATH_ID.

   The following example shows how to execute the command:

   ```
   >dlnkmgr view -path
   ```

2. To change the status of a path to online, execute the `dlnkmgr` command's `online` operation.

   You can specify the paths you want to place online by specifying an HBA port or channel adapter port to which the target paths are connected, or by specifying a single path. However, you can specify the `online` operation for a channel adaptor port only when the HDLM management-target device is the Thunder 9200/9500V series, Lightning 9900/9900V series, TagmaStore, and Universal Storage Platform V. For details on how to specify a path, see section 7.5.

   For example, if you want to place all paths that pass through a specific HBA port online, execute the `dlnkmgr` command's `online` operation with the `-hba` parameter specified. The following shows an example in which the command is executed:

   ```
   >dlnkmgr online -hba 1.1
   KAPL01057-I All the paths which pass the specified HBA will be changed to the
   Online status. Is this OK? [y/n]:y
   KAPL01061-I 3 path(s) were successfully placed online. 0 path(s) could not be
   placed online. Operation name = online
   >
   ```

3. Check the changed status of the path. The following example shows how to execute the command:

   ```
   >dlnkmgr view -path
   ```

4.3.3.2 Changing the Status of a Path to Offline(C)

To change the status of a path to Offline(C):

1. Check the current status of the path. To change the status of the path for each HBA port, channel adapter port, or path to Offline(C), check the path name or AutoPATH_ID.

   The following example shows how to execute the command:

   ```
   >dlnkmgr view -path
   ```

2. To change the status of the path to Offline(C), execute the `dlnkmgr` command's `offline` operation. You can specify the paths you want to place online by specifying an HBA port or channel adapter port to which the target paths are connected, or by specifying a single path. However, you can specify the `offline` operation for a channel adaptor port only when the HDLM management-target device is the Thunder 9200/9500V series, Lightning 9900/9900V series, TagmaStore, and Universal Storage Platform V. For details on how to specify a path, see section 7.4.

   For example, if you want to place all paths that pass through a specific HBA port offline, execute the `dlnkmgr` command's `offline` operation with the `-hba` parameter specified. The following shows an example in which the command is executed:

   ```
   >dlnkmgr offline -hba 1.1
   KAPL01055-I All the paths which pass the specified HBA port will be changed to the
   Offline(C) status. Is this OK? [y/n]:y
   KAPL01056-I If you are sure that there would be no problem when all the paths
   which pass the specified HBA are placed in the Offline(C) status, enter y.
   Otherwise, enter n. [y/n]:y
   KAPL01061-I 3 path(s) were successfully placed offline(C). 0 path(s) could not be
   placed offline(C). Operation name = offline
   >
   ```

3. Check the changed status of the path. The following example shows how to execute the command:

   ```
   >dlnkmgr view -path
   ```

4.3.4 Viewing LU Information Using an HDLM Command

To display LU information, execute the `dlnkmgr` command's `view` operation with the `-lu` parameter specified. The following shows an example in which the command is executed:

```
>dlnkmgr view -lu
Product      : 9500V
SerialNumber : 3679
LUs          : 3

iLU  HDevName PathID Status
0110 G        000002 Online
              000008 Online
0111 F        000001 Online
              000007 Online
0112 E        000000 Online
              000006 Online

Product      : 9970/9980
SerialNumber : 15001
LUs          : 3

iLU  HDevName PathID Status
0580 J        000005 Online
              000011 Online
0585 I        000004 Online
              000010 Online
058A H        000003 Online
              000009 Online
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

For details on the displayed items and their descriptions, see section 7.7.

4.3.5 Initializing Statistical Information for Paths

This subsection explains how to initialize statistical information (I/O counts and I/O errors) for all paths managed by HDLM. This procedure is useful when you wish to check the number of I/O hits and I/O errors that have occurred since the last time the I/O counts and I/O errors were initialized to the
value `0`.

To initialize statistical information for paths:

1. Check the current status of the path. The following shows how to execute the command:

   ```
   >dlnkmgr view -path
   ```

2. To initialize statistical information (I/O counts and I/O errors) for all paths managed by HDLM, execute the `dlnkmgr` command's `clear` operation with the `-pdst` parameter specified. The following shows an example in which the command is executed:

   ```
   >dlnkmgr clear -pdst
   KAPL01049-I Would you like to execute the operation? Operation name = clear
   [y/n]:y
   KAPL01001-I The HDLM command completed normally. Operation name = clear,
   completion time = yyyy/mm/dd hh:mm:ss
   >
   ```

3. Check whether the statistical information for the paths has been initialized. The following shows how to execute the command:

   ```
   >dlnkmgr view -path
   ```

4.3.6 Viewing and Setting Up the Operating Environment

The following subsections explain how to display and set up the HDLM operating environment.

4.3.6.1 Viewing the Operating Environment

To display the operating environment, execute the `dlnkmgr` command's `view` operation with the `-sys` and `-sfunc` parameters specified. The following shows an example in which the command is executed:

```
>dlnkmgr view -sys -sfunc
HDLM Version                  : xx-xx
Service Pack Version          :
Load Balance                  : on(rr)
Support Cluster               : off
Elog Level                    : 3
Elog File Size(KB)            : 9900
Number Of Elog Files          : 2
Trace Level                   : 0
Trace File Size(KB)           : 1000
Number Of Trace Files         : 4
Path Health Checking          : on(30)
Auto Failback                 : off
Remove LU                     : on
Intermittent Error Monitor    : off
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

For details on the displayed items and their descriptions, see section 7.7.

4.3.6.2 Setting Up the Operating Environment

To set up the HDLM operating environment, execute the `dlnkmgr` command's `set` operation. This operation allows you to set the following functions:

- Load balancing
- Path health checking
- Automatic failback
- Intermittent error monitoring
- LU dynamic deletion functionality
- Error log collection level
- Trace level
- Error log file size
- The number of error log files
- Trace file size
- The number of trace files

For details on how to set each function, see section 7.6.

For example, to set up the error log collection level, execute the `dlnkmgr` command's `set` operation with the `-ellv` parameter specified. When the confirmation message is displayed, enter `y` to execute, or `n` to cancel the command.

The following shows an example in which the command is executed:

```
>dlnkmgr set -ellv 1
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y
KAPL01001-I The HDLM command completed normally. Operation name = set, completion
time = yyyy/mm/dd hh:mm:ss
>
```

To check whether the settings have been applied, perform the procedure described in section 4.3.6.1.

4.3.7 Viewing License Information

To display license information, execute the `dlnkmgr` command's `view` operation with the `-sys` and `-lic` parameters specified. The following shows an example in which the command is executed.

```
>dlnkmgr view -sys -lic
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

For details on the displayed items and their descriptions, see section 7.7.

4.3.8 Updating the License

To update the license, execute the `dlnkmgr` command's `set` operation with the `-lic` parameter specified. When the confirmation message is displayed, enter `y` to execute, or `n` to cancel the command. If the license key file does not exist, a message asking you to enter the license key appears, so enter the license key.

Note: When you use the `dlnkmgr` command's `set` operation with the `-lic` parameter to install the license, you can only execute one command at a time. If you attempt to execute more than one `dlnkmgr` command containing the `set` operation with the `-lic` parameter, the following message might appear and HDLM might terminate abnormally:

KAPL01075-E A fatal error occurred in HDLM. The system environment is invalid.

If this message appears, execute the `dlnkmgr` command's `view` operation with the `-sys -lic` parameter to make sure that the license is installed correctly. The following shows an example in which the command is executed:

```
>dlnkmgr set -lic
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y
KAPL01071-I A permanent license was installed.
KAPL01001-I The HDLM command completed normally. Operation name = set, completion
time = yyyy/mm/dd hh:mm:ss
>
```

4.3.9 Viewing HDLM Version Information

To display HDLM version information, execute the `dlnkmgr` command's `view` operation with the `-sys` parameter specified. The following shows an example in which the command is executed:

```
>dlnkmgr view -sys
HDLM Version                : xx-xx
Service Pack Version        :
Load Balance                : on(rr)
Support Cluster             : off
Elog Level                  : 3
Elog File Size (KB)         : 9900
Number Of Elog Files        : 2
Trace Level                 : 0
Trace File Size(KB)         : 1000
Number Of Trace Files       : 4
Path Health Checking        : on(30)
Auto Failback               : off
Remove LU                   : on
Intermittent Error Monitor  : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

4.3.10 Viewing HDLM Component Information

To display HDLM component information, execute the `dlnkmgr` command's `view` operation with the `-sys` parameter specified. The following shows an example in which the command is executed:

```
>dlnkmgr view -sys
HDLM Version                : xx-xx
Service Pack Version        :
Load Balance                : on(rr)
Support Cluster             : off
Elog Level                  : 3
Elog File Size (KB)         : 9900
Number Of Elog Files        : 2
Trace Level                 : 0
Trace File Size(KB)         : 1000
Number Of Trace Files       : 4
Path Health Checking        : on(30)
Auto Failback               : off
Remove LU                   : on
Intermittent Error Monitor  : off
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime          ElogMem Size
Alive             xx-xx    yyyy/mm/dd hh:mm:ss 128
HDLM Driver Ver      WakeupTime
Alive       xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

Among the displayed items, `HDLM Manager`, `HDLM Alert Driver`, and `HDLM Driver` indicate the HDLM component information.

You can also view information for each HDLM component. Execute the `dlnkmgr` command's `view` operation with the `-sys` and subsequent parameter specified. The following shows an example in which the command is executed:

```
>dlnkmgr view -sys -msrv
>dlnkmgr view -sys -adrv
>dlnkmgr view -sys -pdrv
```

4.4 Using the Windows Administrative Tool to Check Path Information

In the Windows administrative tool, you can use **Performance** to check path information. The following shows the procedure for adding a counter that HDLM provides.

Note: In Windows Server 2003 (IPF and x64) environment, the function of Using the Windows administrative tool to check path information is not supported.

To add a counter:

1. Choose **Start**, **Settings**, and then **Control Panel**. Double click **Administrative Tools. Then, double click Performance.** The Performance window appears.
2. Right-click the pane showing the system monitor details, and then choose **Add Counters**. The Add Counters window appears.
3. Select the performance object, counter, and instance. In the **Performance object** drop-down list, select **HDLM**.

   In the list box on the lower-left side of the window, select the counter you want to monitor. To monitor all counters, select the **All counters** check box. Table 4.2 lists the counters you can select.

   In the list box on the lower-right side of the window, select the instance you want to monitor. To monitor all instances and the total number value, select the **All instances** check box.

   Table 4.3 lists and describes selectable items for the instances displayed in the list box.
4. Click the **Add** button. Monitoring of path information starts.

Table 4.2 List of Counters

Counter Name	Description
Avg.Disk Bytes/Transfer	The average number of bytes transferred between disks during one operation.
Avg.Disk Bytes/Read	The average number of bytes transferred from the disk during one operation.
Avg.Disk Bytes/Write	The average number of bytes transferred to the disk during one operation.
Disk Bytes/Sec	The amount of data transferred per second between disks during read or write operations.
Disk Read Bytes/Sec	The amount of data transferred per second from the disk during read operations.
Disk Write Bytes/Sec	The amount of data transferred per second to the disk during write operations.

Table 4.3 Selectable Items for Instances

Selectable Items*	Description
_Total	Selecting this item displays the total value of each instance.
pathid disk-number drive-letter:	Selecting this item displays the instance of the selected path. The following items are displayed for each path (sorted in ascending order of *pathid*): ■ The path management PATH_ID is indicated by *pathid*. This is the same value as when PathID is displayed by executing the dlnkmgr command's view operation with the -path parameter. ■ The Windows disk number of disks displayed in the Disk Management window is indicated by *disk-number*. If acquisition of a disk number fails, a hyphen (-) is displayed. ■ Windows drive letters are indicated by *drive-letter*. This is the same value as when HDevName is displayed by executing the dlnkmgr command's view operation with the -path parameter. If you are using a dynamic disk, or if the drive letter is not assigned, a hyphen (-) is displayed.
* If an LU managed by HDLM does not exist, <No Instances> will be displayed.	

4.5 Starting and Stopping the HDLM Manager

If an error occurs in the system, such as in an HDLM program, you may need to manually stop or start HDLM to recover from the error. The following subsections describe these processes.

4.5.1 Starting the HDLM Manager

During installation, the HDLM manager is registered as a Windows service and the startup type is set to **Automatic**. This means that when Windows starts, the HDLM manager also starts automatically. If, for some reason, the HDLM manager has not started, start it as follows:

Log on to Windows as a member of the administrators group. In **Control Panel**, choose **Administrative Tools** and then **Services**. From the list of services, double-click **DLMManager**, and then click the **Start** button.

Use one of the following procedures to confirm that the HDLM manager is active:

When using the `dlnkmgr` command's `view` operation:

Execute the following command:

```
>dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

When the `HDLM Manager` column shows `Alive`, the HDLM manager is active.

When using the HDLM GUI, click the **Component Information** button of Options window to display the HDLM Component information dialog box. If the **Status** of **HDLM manager** shows **Alive**, the HDLM manager is active.

4.5.2 Stopping the HDLM Manager

When you uninstall HDLM or install an HDLM upgrade or re-installation, the HDLM manager automatically stops.

If, for some reason, the HDLM manager does not automatically stop, stop it using the following procedure:

1. Log on to Windows as a member of the administrators group.
2. In **Control Panel**, choose **Administrative Tools** and then **Services**. From the list of services, double-click **DLMManager**, and then click the **Stop** button.
3. Use the following `dlnkmgr` command's `view` operation to confirm that the HDLM manager has stopped.

```
>dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Dead
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
>
```

When the `HDLM Manager` column shows `Dead`, the HDLM manager is inactive.

4.6 Reconfiguring the HDLM operating environment

This section describes the procedures for changing an LU and a path configuration.

Using the Windows plug-and-play functionality, which is called a dynamic reconfiguration functionality, you can add an LU and a path when the host installing HDLM is running.

4.6.1 Setting Up an Added LU and Path as an HDLM Management-Target

This subsection explains the procedure for setting up an added LU and path as an HDLM management-target.

When using HDLM, you need to write a signature, create partitions, and perform formatting for an added LU.

4.6.1.1 Setting up an Added LU as an HDLM Management-Target

When MSCS is not used

1. Add an LU.

   Some storage systems need to be restarted. Follow the manuals for the storage system.

2. Display **Disk Manager**.

3. If the LU is not displayed in the Disk Management window, perform the following operations to add the LU as an HDLM management-target.

   - In the Device Manager window of Windows, select **Disk drives** and then click **Scan for hardware changes**.
   - In the Disk Management window of Windows, click **Rescan Disks**.

4. Use the `dlnkmgr view -path` command or the HDLM GUI to confirm that the PathID has been added.

   Figure 4.1 shows an example of using the `dlnkmgr view -path` command to confirm that an LU has been added.

Before addition of LU

```
>dlnkmgr view -path
Paths:000002    OnlinePaths:000002
PathStatus      IO-Count        IO-Errors
Online          1486            0

PathID  PathName                          DskName                 iLU  ChaPort Status  Type IO-Count IO-Errors  DNum HDevName
000000  0004.0001.0000000000000000.0001 HITACHI .DF600F .0051   0010 0A      Online  Own  1427     0           0    F
000001  0005.0001.000000000000007A.0001 HITACHI .DF600F .0051   0011 1A      Online  Non  59       0           0    D

KAPL01001-I The HDLM command completed normally. Operation name =view, completion time = yyyy/mm/dd hh:mm:ss
>
```

After addition of LU

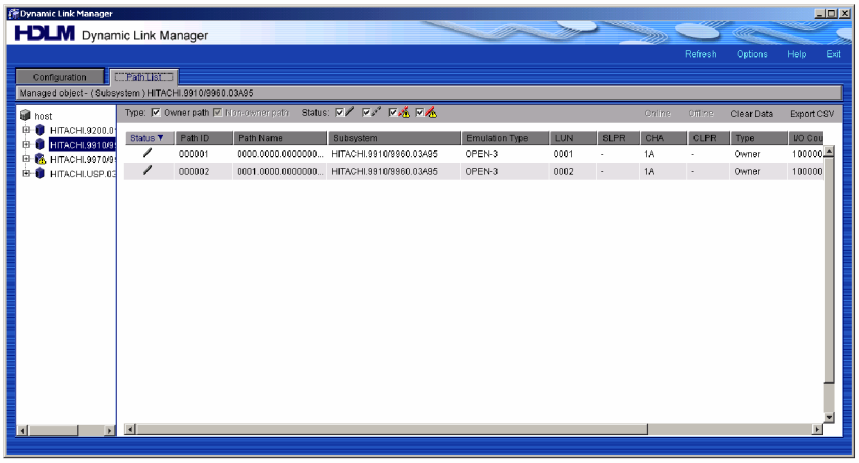
```
>dlnkmgr view -path
Paths:000003    OnlinePaths:000003
PathStatus      IO-Count        IO-Errors
Online          1609            0

PathID  PathName                          DskName                 iLU  ChaPort Status  Type IO-Count IO-Errors  DNum HDevName
000000  0004.0001.0000000000000000.0001 HITACHI .DF600F .0051   0010 0A      Online  Own  1427     0           0    F
000001  0005.0001.000000000000007A.0001 HITACHI .DF600F .0051   0011 1A      Online  Non  59       0           0    D
000002  0006.0001.000000000000007A.0001 HITACHI .DF600F .0051   0020 1A      Online  Non  123      0           0    -
KAPL01001-I The HDLM command completed normally. Operation name =view, completion time = yyyy/mm/dd hh:mm:ss
>
```

LU information that was added

Figure 4.1 Using the dlnkmgr view -path Command to Confirm LU Addition

Figure 4.2 shows an example of using the HDLM GUI to confirm that an LU has been added.

Before addition of LU



After addition of LU

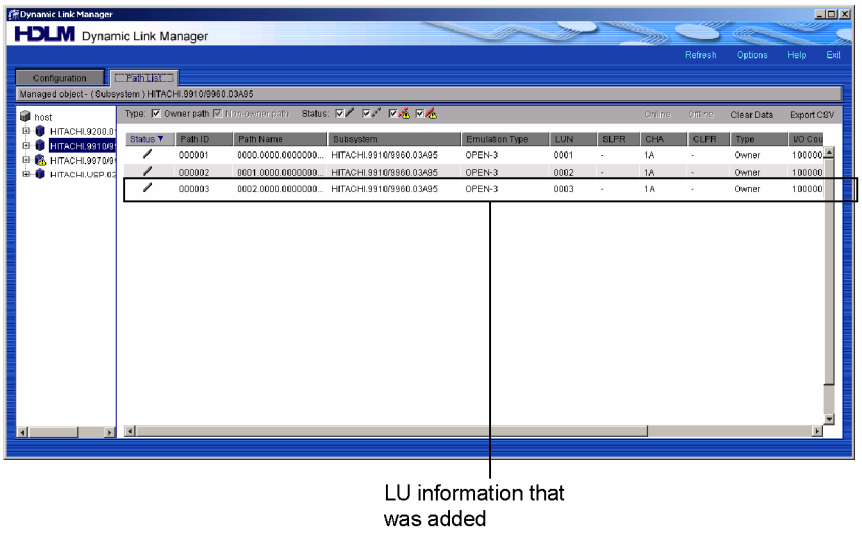


Figure 4.2 Using the HDLM GUI to Confirm LU Addition

5. For the new LU, write a signature, create partitions, and perform formatting.

Note: A PathID is added to a minimum available number in ascending order. Once you delete a path, a different PathID might be assigned when you add a path again. Note that the previous number might not be assigned.

When MSCS is used:

1. Add an LU.
2. Stop node B.
3. In node A, perform the steps shown in *When MSCS is not used*.
4. Stop node A, and then start node B.
5. In node B, perform the steps shown in *When MSCS is not used*.

   When you create a partition, assign the same drive letter as the one assigned for node A in step 3.
6. Stop node B, and then start node A.
7. In node A, register the new LU in MSCS, and set it up.
8. Start node B.

4.6.1.2 Checking an Added Path

You can add a path by inserting a cable into an existing LU when the host installing HDLM is running. When you add only a path and do not add an LU, the display of the disk management is not changed.

Figure 4.3 shows an example of using the `dlnkmgr view -path` command to confirm that a path has been added.

Before addition of path

```
>dlnkmgr view -path
Paths:000002    OnlinePaths:000002
PathStatus      IO-Count        IO-Errors
Online          1486            0

PathID  PathName                          DskName                 iLU  ChaPort Status  Type IO-Count IO-Errors  DNum HDevName
000000  0004.0001.0000000000000000.0001 HITACHI .DF600F .0051  0010 1A      Online  Own  1427     0           0    F
000001  0005.0001.000000000000007A.0001 HITACHI .DF600F .0051  0011 1A      Online  Non  59       0           0    D
KAPL01001-I The HDLM command completed normally. Operation name =view, completion time = yyyy/mm/dd hh:mm:ss
>
```

After addition of path

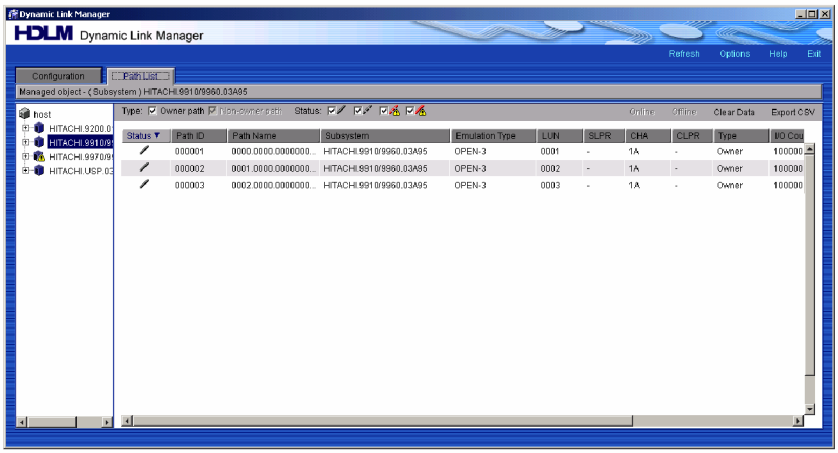
```
>dlnkmgr view -path
Paths:000003    OnlinePaths:000003
PathStatus      IO-Count        IO-Errors
Online          1609            0

PathID  PathName                          DskName                 iLU  ChaPort Status  Type IO-Count IO-Errors  DNum HDevName
000000  0004.0001.0000000000000000.0001 HITACHI .DF600F .0051  0010 1A      Online  Own  1427     0           0    F
000001  0005.0001.000000000000007A.0001 HITACHI .DF600F .0051  0011 1A      Online  Non  59       0           0    D
000002  0006.0001.000000000000007A.0001 HITACHI .DF600F .0051  0010 0A      Online  Non  123      0           0    F
KAPL01001-I The HDLM command completed normally. Operation name =view, completion time = yyyy/mm/dd hh:mm:ss
>
```

Path information that was added

Figure 4.3 Using the dlnkmgr view -path Command to Confirm Path Addition

Figure 4.4 shows the example of using the HDLM GUI to confirm that a path has been added.

Before addition of path



After addition of path

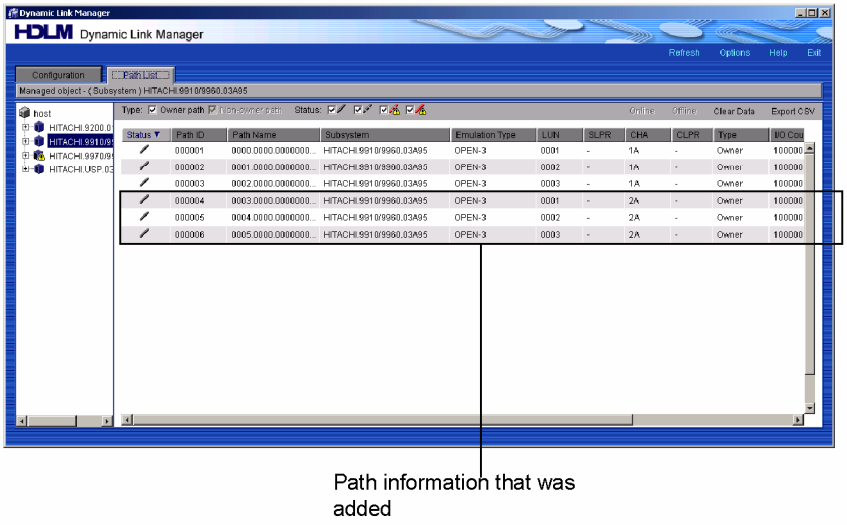


Figure 4.4 Using the HDLM GUI to Confirm That a Path Has Been Added

Notes:

- A PathID is added to a minimum available number in ascending order. Once you delete path, a different PathID might be assigned when you add a path again. Note that the previous number might not be assigned.
- When a path is added to an LU, the following messages might appear:
  - KAPL08019-E and KAPL08022-E
  - KAPL05301-E

  These messages are output by Windows activities, and not by an error.

4.6.2 Deleting an LU Dynamically

The LU deletion functionality automatically removes an LU from HDLM management when all the paths to that LU are disconnected.

You can set the LU deletion functionality by specifying the `dlnkmgr` command's `set` operation together with the `-rmlu on` parameter in the HDLM command. You can also set this functionality in the Options window of the HDLM GUI. For details on the Options window, or `set` operation, see section 3.5.2.

4.6.2.1 Requirements for Deleting the LU Dynamically

An LU is deleted when all the paths to that LU are disconnected. This means that an LU is deleted when HLU is deleted. When using the `dlnkmgr` command's `set` operation to dynamically delete an LU, depending on the settings the following differences exist:

- When the `-rmlu on` parameter is specified, the LU is not removed from HDLM management if the disconnected paths include a path in the `Offline(C)` status.
- When the `-rmlu on -force` parameter is specified, the LU is removed from HDLM management even if the disconnected paths include a path in the `Offline(C)` status.

4.6.2.2 Confirming Dynamic Deletion

This section explains the two operations for confirming that the LU or path is deleted by using the LU deletion functionality. One operation is performed when the user intentionally deletes an LU or path, and the other operation is performed when an LU or path is deleted because all the paths are disconnected.

Intentional Path Deletion

Use the disk administrator, HDLM command, or HDLM GUI to confirm that LU or path has been deleted.

Deletion Caused by Path Disconnection

If an LU or path was deleted due to disconnection of a path, HDLM outputs the KAPL05301-E message to the event log.

Note: When an LU is deleted from the HDLM management target by using the LU deletion functionality, the KAPL08022-E message might not be output to the event log. In this case, refer to the KAPL05301-E message to check the path information.

Figure 4.5 shows the example of displaying the KAPL05301-E message.

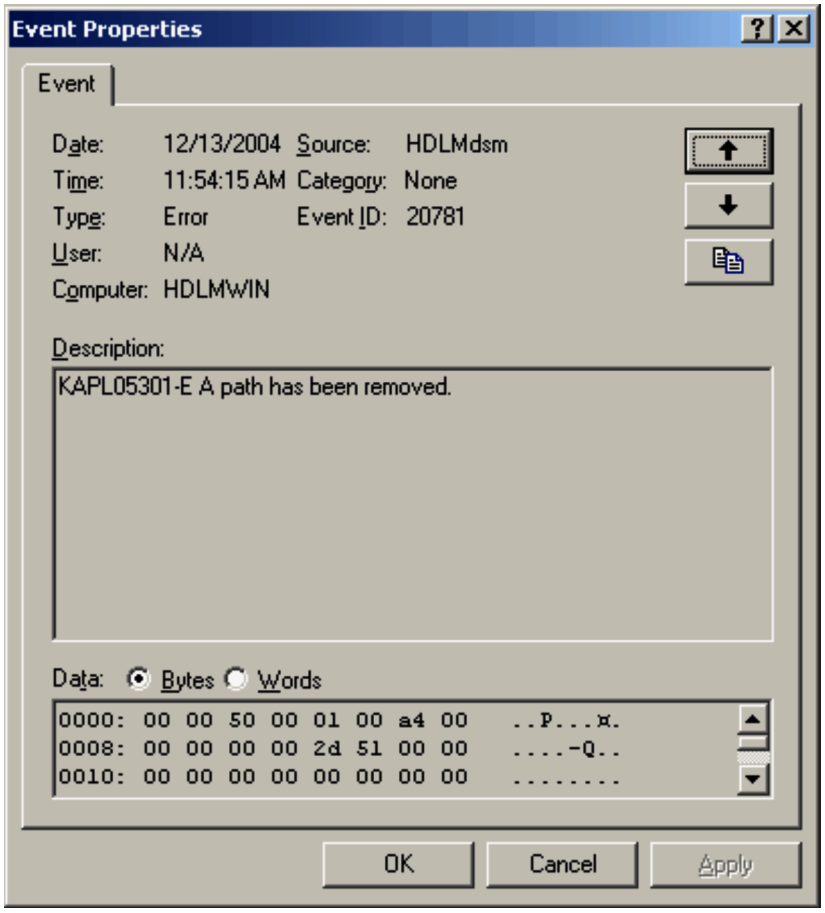


Figure 4.5 Displaying the KAPL05301-E Message

In the event viewer, the information about the deleted path is displayed in the format: PathID PathName DskName iLU ChaPort.

Figure 4.6 shows an example of outputting data to the KAPL05301-E message.

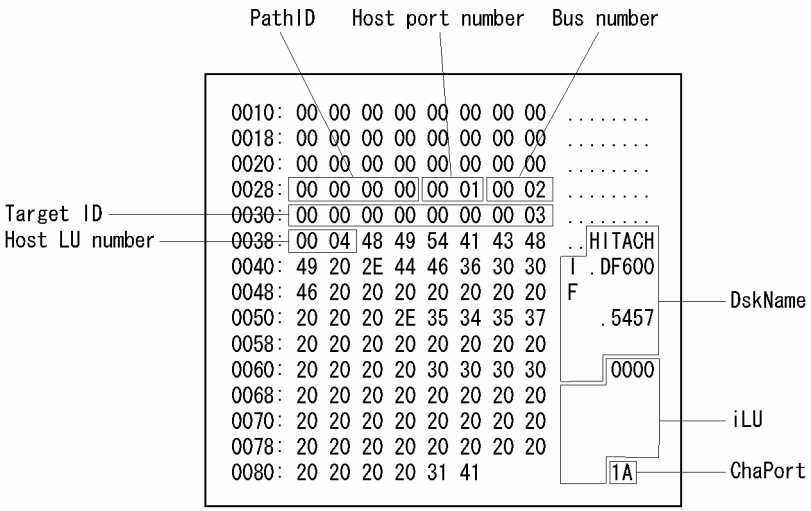


Figure 4.6 Outputting Data to the KAPL05301-E Message

Table 4.4 shows the items and descriptions for the path information, displayed in the KAPL05301-E message.

Table 4.4 Items and Descriptions for Path Information Displayed in KAPL05301-E Message

Item	Description
PathID	An AutoPATH_ID.
Host port number	Elements of a PathName.
Bus number	
Target ID	
Host LU number	
DskName	The displayed contents differ depending on whether the HDLM management-target device is the TagmaStore, Thunder 9200/9500V series, Lightning 9900/9900V series, Universal Storage Platform V or a product other than these.
iLU	
ChaPort	

See the path information and check the LU that was deleted, and then take actions according to the path error. For details on how to take actions for the path error, see section 5.3.

4.6.2.3 Recovering the Deleted LU or Path

To restore the deleted LU, recover it from physical failure and then perform the operations below. For a path error, remove the cause of the path error and then perform the following. Note that sometimes they are automatically recovered without performing the following operations.

- In the Device Manager window of Windows, select **Disk drives** and then click **Scan for hardware changes**.
- In the Disk Management window of Windows, click **Rescan Disks**.

Chapter 5 Troubleshooting

This chapter describes how to check HDLM error information, and how to take action if an error occurs in HDLM. The actions you should take are described separately for path errors, for HDLM program errors, and for other types of errors. Troubleshooting information is broken down into the following sections:

- Information collected by the DLMgetras utility for collecting HDLM error information (see section 5.1)
- Checking error information in messages (see section 5.2)
- Actions taken for a path error (see section 5.3)
- Actions taken for a program error (see section 5.4)
- Actions taken for other errors (see section 5.5)

5.1 Information Collected by the DLMgetras Utility for Collecting HDLM Error Information

Immediately after an error occurs, execute the error information collection utility, `DLMgetras`, since restarting the machine may delete information collected. For details about the `DLMgetras` utility and the error information it collects, see section 8.2.

5.2 Checking Error Information in Messages

You can check path errors by referring to the KAPL08xxx messages output to event log. To obtain detailed information about a path, check the following windows according to the type of message".

- For the HDLM GUI, check the **Path List** view in the Path Management window.
- For a command, check the execution results of the `view` operation.

Based on the applicable message, detailed information about a path can be obtained by checking the execution results of the `view` operation. Following are examples of messages.

- Message output when a path error occurs:

  `KAPL08022-E A path error occurred. ErrorCode = aa...aa, PathID = bb...bb, PathName = cc...cc.dd...dd.ee...ee.ff...ff,DNum = gg...gg,HDevName = hh...hh`

  `KAPL08019-E The path (aa...aa) detected an error (bb...bb). (cc...cc)`

- Message output when there are no online paths to the LU:

  `KAPL08026-E An error occurred on all the paths of the LU. PathID = aa...aa`

- Message output when the LU dynamic removal functionality is used and there are no online paths to the LU:

  `KAPL05301-E Path has been removed.`

Notes:

- When a path is added to an LU, the following messages might appear:
  - KAPL08019-E and KAPL08022-E
  - KAPL05301-E

  Note that these messages are output by Windows activities, and not by an error.
- When an LU is deleted from the HDLM management target by using the LU deletion functionality, the KAPL08022-E message might not be output to the event log. In this case, refer to the KAPL05301-E message to check the path information.

Each message contains several elements. These elements are explained below.

ErrorCode

The error number generated when Windows detected the path error.

PathID

The ID assigned to a path. This ID is called the AutoPATH_ID. AutoPATH_IDs are re-assigned every time the host is restarted.

This path ID is the same as the path ID displayed in the **Path List** view in the Path Management window.

The path ID is also the same as PathID displayed by the command's view operation.

PathName

The path name, which indicates a physical path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the physical paths that will be affected by the change.

A path name consists of the following four elements, separated by periods:

- Host port number (hexadecimal)
- Bus number (hexadecimal)
- Target ID (hexadecimal)
- Host LU number (hexadecimal)

This name is the same as the path name displayed in the **Path List** view in the Path Management window for the HDLM GUI. For details on the path names, see section 6.2.4 for the HDLM GUI.

The path name is also the same as PathName displayed by the command's view operation. For details on the path name, see section 7.7.

DNum

A Dev number. A 0 is displayed for a Dev that indicates the entire LU.

This is the same as the DNum that is displayed by the view operation. For details on the view operation, see section 7.7.

HDevName

The name of the host device.

A drive letter appears. If no drive letter has been assigned, a hyphen (-) appears.

This is the same as the HDevName that is displayed by the view operation. For details on the view operation, see section 7.7.

5.3 Actions for a Path Error

When a path error is detected by HDLM, you must immediately resolve the error and restore the path.

A check for path errors is performed whenever an I/O is issued, or the Windows Plug and Play function detects that the paths are disconnected. If there are any paths through which I/O is not normally issued, such as a non-owner path, you should enable path health checking in order to detect errors regardless of I/O issuance. For details about path health checking, see section 2.9.

When a path error is detected, HDLM performs failover for the path and outputs the KAPL08022-E message. This message indicates that an error has occurred in the components that make up the path. Figure 5.1 shows these components.

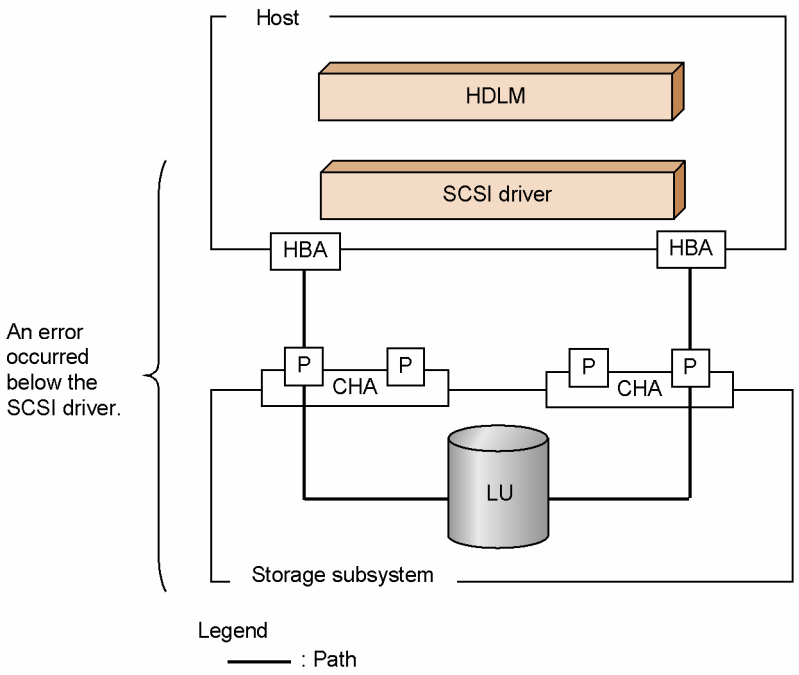


Figure 5.1 Error Location when KAPL08022-E Message is Output

Figure 5.2 shows the troubleshooting procedure when a path error occurs.

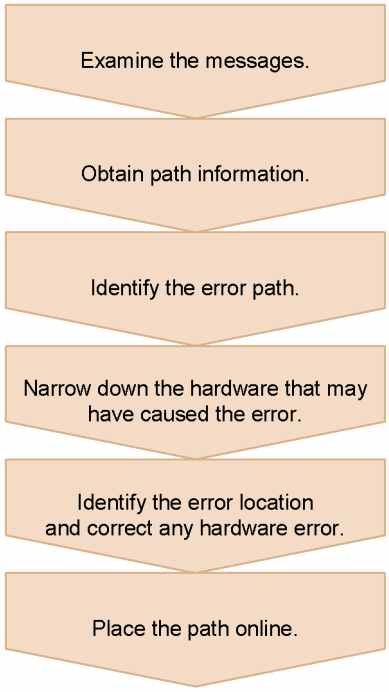


Figure 5.2 Troubleshooting Procedure when a Path Error Occurs

5.3.1 Using the HDLM GUI to Handle a Path Error

The following shows the procedure for handling a path error using the HDLM GUI.

5.3.1.1 Examine the Messages

Examine the message that is output to the event log in the host for monitoring messages. If the KAPL08022-E message is output, view that message to check the path in which the error occurs. For details on the message, see section 5.2.

If an error occurred in all the paths to the LU, the KAPL08022-E message appears, in addition to the KAPL08026-E message.

If you delete all the paths when using the LU dynamic deletion functionality, the KAPL05301-E message appears.

5.3.1.2 Obtain Path Information

Obtain path information to narrow down the hardware in which the error occurred. To view path information:

1. Open the Path Management window.

   The **Path List** view appears.

5.3.1.3 Identify the Error Path

Check the path information displayed in the Path List view to identify the error path. In the Status column, the error path has the status  (`Offline(E)` or `Offline(P)`) or  (`Online(E)` or `Online(EP)`).

If the intermittent error monitoring functionality is enabled, the icon flashes when an intermittent error occurs in the path (The icon lights for 3 seconds and then goes out for 0.2 seconds, repeatedly).

5.3.1.4 Narrow Down Hardware Causes

Check the value displayed in the System, LUN, and CHA columns for the error path to narrow down the hardware that may be the cause of the error. To physically identify the hardware corresponding to System, LUN, and CHA, use the information provided by the storage-system management program.

5.3.1.5 Identify the Error Location and Correct Hardware Errors

Use the Windows and hardware management tools to identify the error location, and then take appropriate, corrective action. If an error occurs in the path, HDLM outputs an error message to the event log of the host. Information about the path in which the error occurred is also output to the event log. For hardware maintenance, contact your hardware vendor or maintenance company if there is a maintenance contract.

5.3.1.6 Place the Path Online

After the path recovers from the error, use the Path Management window to place online the path that went offline due to the error.

To place the offline paths online:

1. Display the Path Management window.
2. Make sure that no path is selected in the **Configuration** view or **Path List** view, and then click the **Online** button. All offline paths that are displayed in the **Configuration** view or the **Path List** view are placed online. If any path cannot be placed online due to an error, the KAPL02022-W message appears. To ignore such paths and to continue processing, click the **OK** button. To cancel the processing, click the **Cancel** button. Check the status of the paths that cannot be placed online, and take appropriate, corrective action.
3. Close the Path Management window.

Notes:

- Even if you select the paths in the `Offline(E)` status in the Path Management window and click the Online button, some paths may not be placed online. In this case, use the Path Management window to change those paths from the `Offline(E)` status to the `Offline(C)` status. Then, place the paths online. The system automatically checks whether the target paths are available, puts available paths into the `Online` status, and puts unavailable paths into the `Offline(E)` status. The paths in the `Offline(E)` status have not recovered from an error yet. Take corrective action for the error, and then use the Path Management window to place the paths online again.
- If path errors occur on all of the paths, and some or all of the paths are recognized by Windows, disk numbers might then be changed from the ones that were assigned when the host started. If this happens, restarting the host will cause the disk numbers to be changed back to the ones that were assigned when the host started. After the disk numbers have changed back, use Veritas Backup Exec for Windows or the Intelligent Disaster Recovery functionality of Veritas NetBackup.

5.3.2 Using the dlnkmgr Command to Handle a Path Error

The following subsections show the procedure for using the HDLM command (`dlnkmgr`) to handle a path error.

5.3.2.1 Examine the Messages

Examine the message that is output to the event log in the host for monitoring messages. If the KAPL08022-E message is output, view the message to check the path in which the error occurs. For details on each item displayed in the message, see section 5.2.

If an error occurred in all the paths to the LU, the KAPL08022-E message appears, in addition to the KAPL08026-E message.

When using the LU dynamic deletion functionality, the KAPL05301-E message appears if all paths are deleted.

5.3.2.2 Obtain Path Information

Obtain path information to narrow down the hardware in which the error occurred. Execute the following command:

```
>dlnkmgr view –path –iem > pathinfo.txt
```

The redirection-output file name is `pathinfo.txt`. Use a file name that matches your environment.

5.3.2.3 Identify the Error Path

Check the obtained path information to find the error path. In the `Status` column, the error path has the status `Offline(E)` or `Online(E)`.

5.3.2.4 Narrow Down Hardware Causes

Check the `DskName`, `iLU`, and `ChaPort` columns for the error path to narrow down the hardware that may be the cause of the error. To physically identify the hardware corresponding to `DskName`, `iLU`, and `ChaPort`, use the information provided by the storage-system management program.

5.3.2.5 Identify the Error Location and Correct Hardware Errors

Use the Windows and hardware management tools to identify the error location, and then take appropriate, corrective action. If an error occurs in the path, HDLM outputs an error message to the event log of the host. Information about the path in which the error occurred is also output to the event log. For hardware maintenance, contact your hardware vendor or maintenance company if there is a maintenance contract.

5.3.2.6 Place the Path Online

After the path recovers from the error, use the `dlnkmgr` command's `online` operation to place online the path that went offline due to the error. For details on the `online` operation, see section 7.5. Execute the following command:

```
>dlnkmgr online
```

Executing this command places all the offline paths online. If any path cannot be placed online due to an error, the KAPL01039-W message appears. To ignore such paths and to continue processing, type `y`. Type `n` to cancel the processing. Check the status of the paths that cannot be placed online, and take appropriate, corrective action.

Notes:

- Even if you execute the `dlnkmgr` command's `online` operation (with the `-pathid` parameter) for the paths in the `Offline(E)` status, some paths may not be placed online. In this case, use the `offline` operation to change those paths from the `Offline(E)` status to the `Offline(C)` status. Then, execute the `online` operation. The system automatically checks whether the target paths are available, puts available paths into the `Online` status, and puts unavailable paths into the `Offline(E)` status. The paths in the `Offline(E)` status have not recovered from an error yet. Take corrective action for the error, and then execute the `online` operation again.
- If path errors occur on all of the paths, and some or all of the paths are recognized by Windows, disk numbers might then be changed from the ones that were assigned when the host started. If this happens, restarting the host will cause the disk numbers to be changed back to the ones that were assigned when the host started. After the disk numbers have changed back, use Veritas Backup Exec for Windows or the Intelligent Disaster Recovery functionality of Veritas NetBackup.

5.4 Actions for Program Errors

The following describes the troubleshooting procedure for handling errors that occur in an HDLM program. Figure 5.3 shows the troubleshooting procedure.

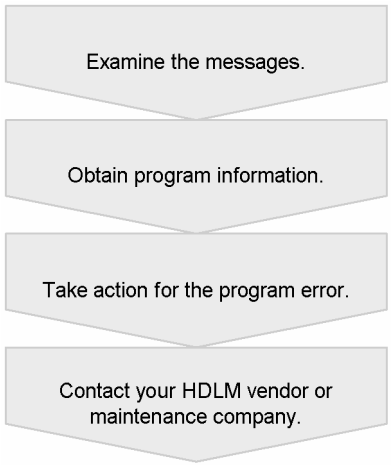


Figure 5.3 Troubleshooting a Program Error

The following subsections describe the troubleshooting procedures for handling a program error. The first subsection explains the procedure when using the GUI, and the second subsection explains the procedure when using the HDLM command (dlnkmgr).

5.4.1 Using the HDLM GUI to Handle a Program Error

The following shows the procedure for handling a program error by using the HDLM GUI.

5.4.1.1 Examine the Messages

Examine the message that is output to the event log in the host. If an error occurs in an HDLM program, a message other than KAPL08xxx is output to the event log. Check the output message. Messages with error level `E` (Error) or higher require corrective action.

5.4.1.2 Obtain Program Information

Obtain the information to be reported to your HDLM vendor or maintenance company (if there is a maintenance contract for HDLM). Use the `DLMgetras` utility for collecting HDLM error information to collect the error information. For details about the `DLMgetras` utility and the information it collects, see section 8.2.

Some of the information collected by the `DLMgetras` utility might be cleared when the system is restarted. When an error occurs, as soon as possible execute the `DLMgetras` utility.

When an error occurs in the HDLM GUI, collect the screenshot at the time the error occurred.

5.4.1.3 Take Action for the Program Error

Take the action recommended for the program error message as described in Chapter 9. If the error occurs again after you take the corrective action, use the Options window to check the status of the HDLM program, and then take the appropriate corrective action.

To check the status of an HDLM program:

1. Display the Path Management window. The **Path List** view appears in the Path Management window.
2. Click the **Options** button. The Options window appears.
3. Click the **Component information** button. The HDLM Component information dialog box appears. This dialog box displays information about the HDLM manager, HDLM alert driver, and HDLM driver.
4. Check the information displayed for **HDLM manager**, **HDLM driver**, and **HDLM alert driver**, and take the following action:
   - If the status of the HDLM manager shows `Dead`, start the HDLM manager.
   - If the status of the HDLM alert driver shows `Dead`, restart the host.
   - If the status of the HDLM driver shows `Dead`, restart the host.

5.4.1.4 Contact Your HDLM Vendor or Maintenance Company

If the error cannot be resolved, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM, and report the information collected by the `DLMgetras` utility.

5.4.2 Using the dlnkmgr Command to Handle a Program Error

The following subsections describe the procedures for handling a program error by using the HDLM command (dlnkmgr).

5.4.2.1 Examine the Messages

Examine the message that is output to the event log in the host. If an error occurs in an HDLM program, a message other than KAPL08xxx is output to the event log. Examine the content of the message. Messages with error level `E` (Error) or higher require corrective action.

5.4.2.2 Obtain Program Information

Obtain the information to be reported to your HDLM vendor or maintenance company (if there is a maintenance contract for HDLM).

Use the DLMgetras utility for collecting HDLM error information to collect the error information. For details on the DLMgetras utility and the information it collects, see section 8.2.

Some of the information collected by the DLMgetras utility might be cleared when the system is restarted. When an error occurs, as soon as possible execute the DLMgetras utility.

When an error occurs in the HDLM GUI, collect the screenshot at the time the error occurred.

5.4.2.3 Take Action for the Program Error

Take the action recommended for the program error message as described in Chapter 9. If the error occurs again after you take the corrective action, use the dlnkmgr command's view operation to check the status of the HDLM program, and then take the appropriate corrective action. For details on the view operation, see section 7.7.

Execute the following command:

```
>dlnkmgr view -sys
```

If the KAPL01012-E message appears as a result of executing the command

The following shows the KAPL01012-E message:

```
KAPL01012-E Could not connect the HDLM manager. Operation name = view
```

Start the HDLM manager.

For details about how to start the HDLM manager see section 4.5.1.

If the KAPL01013-E message appears as a result of executing the command

The following shows the KAPL01013-E message:

```
KAPL01013-E An error occurred in internal processing of the HDLM command. Operation
name = view details = aa...aa
```

aa...aa indicates character string. Restart the host.

5.5 Actions Taken for Other Errors

When the cause of an error may be related to HDLM but is neither a path error nor an HDLM program error, execute the `DLMgetras` utility for collecting HDLM error information, and then report the collected information to the HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details about the `DLMgetras` utility and the information it collects, see section 8.2.

Chapter 6 GUI Reference

This chapter explains the items displayed in the HDLM GUI windows. Reference information is included in the following sections:

- HDLM GUI windows (see section 6.1)
- Path Management window (see section 6.2)
- Options window (see section 6.3)

6.1 HDLM GUI Windows

This section explains the windows that make up the HDLM GUI and the window transitions (that is, how the user moves from one window to another).

You can use the HDLM windows to perform the same operations as you would perform using the HDLM command. You can also use HDLM windows, together with HDLM commands, to operate HDLM. For example, when you execute a command, the result of the command will be reflected in an HDLM window. Likewise, when you use the HDLM windows to operate HDLM, the results can be displayed by executing the `dlnkmgr` command's `view` operation. For details about the `view` operation, see section 7.7.

6.1.1 List of HDLM Windows

HDLM has the following three windows:

- Path Management window. You use this window to view path information or change the path status. For details, see section 6.2.
- Options window. You use this window to view or change the HDLM operating environment. For details, see section 6.3.
- Help window. You use this window to view the HTML version of this manual using a Web browser.

6.1.2 Window Transitions

Figure 6.1 shows the transitions among HDLM windows.ss

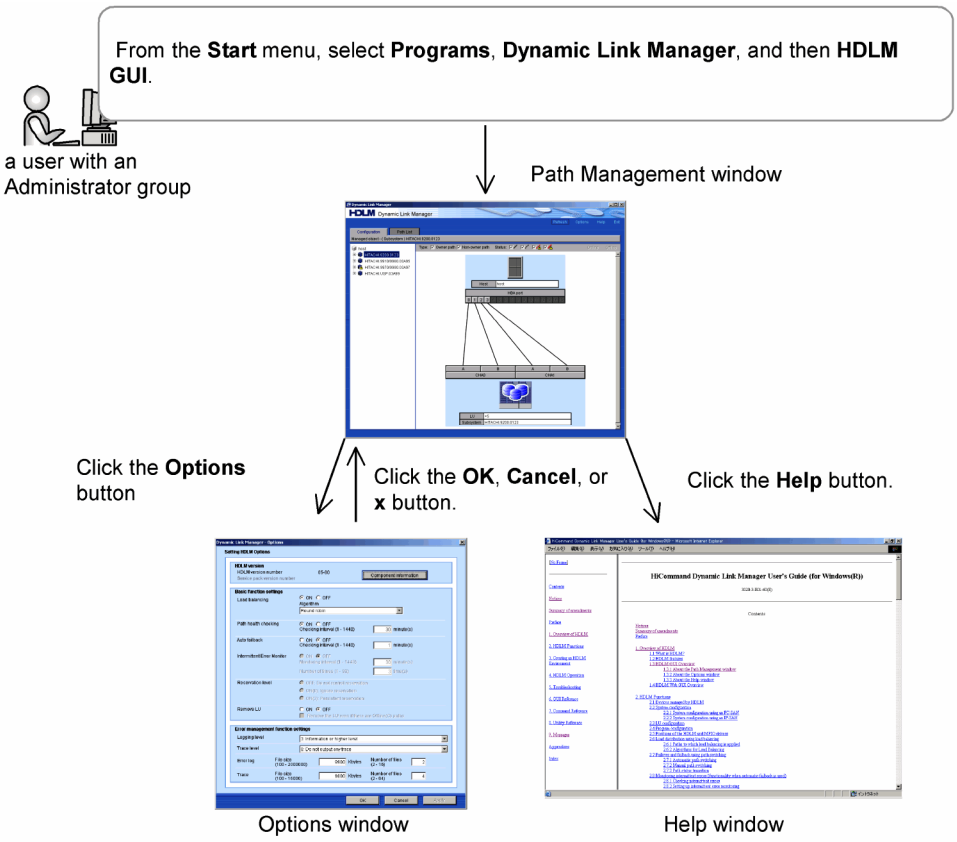


Figure 6.1 Window Transitions

When you display the Options window or Help window from the Path Management window, the Options or Help windows are displayed as separate windows. Note, however, that while the Options window is displayed, you cannot perform any operations in the Path Management window.

6.2 Path Management Window

This section explains the Path Management window. In this window, you can do the following:

- View path information. For details, see section 4.2.3.
- Export path information to a CSV file. For details, see section 4.2.4.
- In the path information, set the I/O count and the I/O error count to 0. For details, see section 4.2.5.
- Change the path status. For details, see section 4.2.6.
- Refresh the display of path information. For details, see section 4.2.7.
- Open the Options window. For details, see section 4.2.8.
- View the HDLM HTML manual. For details, see section 4.2.9.

Each Path Management window shows information about the paths connected to a certain host. Since up to four Path Management windows can be open at one time, information for up to four hosts can be displayed concurrently.

Figure 6.2 shows the Path Management window.

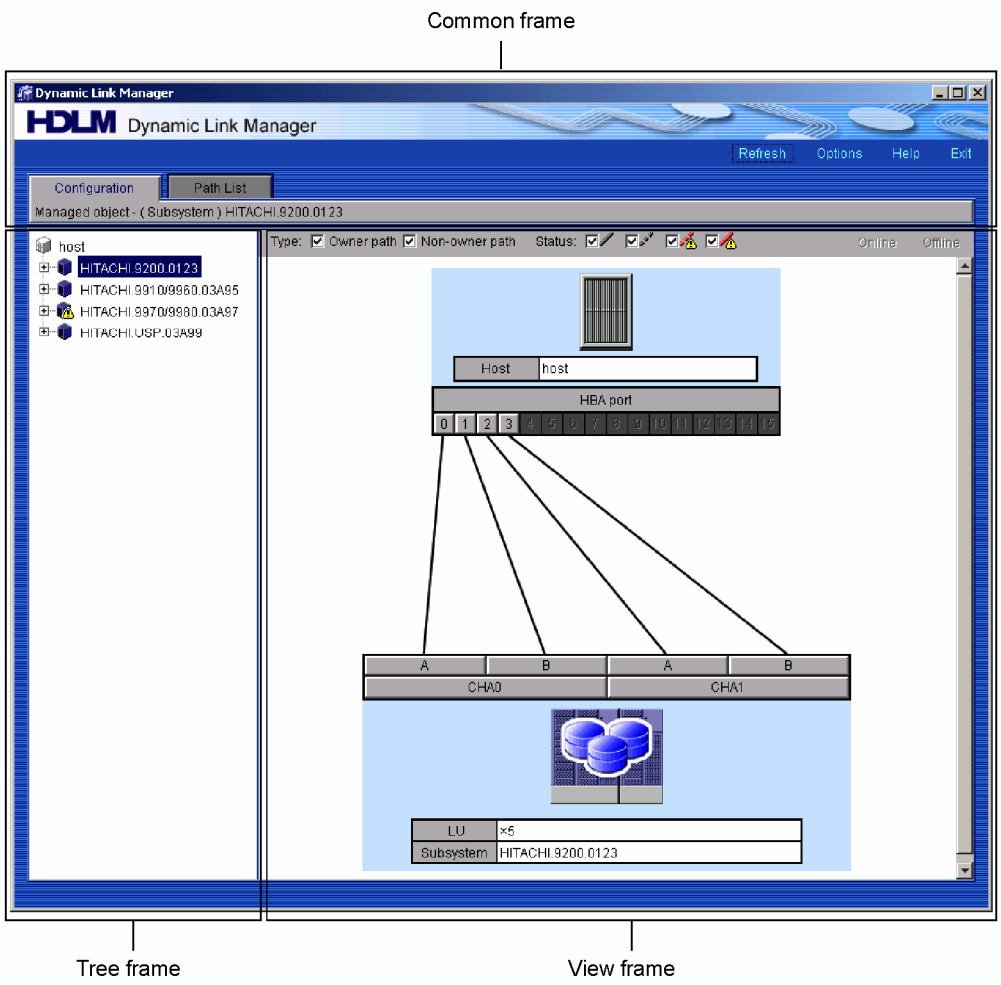


Figure 6.2 Path Management Window

As shown in Figure 6.2, the Path Management window is composed of the following three frames:

- Common frame

  Displays the title, logo, and buttons that are used throughout the HDLM GUI.

- Tree frame

  Displays, in tree format, the storage systems and LUs that are managed by the host.

- View frame

  Displays the path configuration view or path list view.

The view frame displays the **Configuration** view or the **Path List** view

The following subsections describe the frames of the Path Management window.

6.2.1 Common Frame

The buttons in the common frame are:

- **Refresh button:** Reflects the most recent path information in the Path Management window.
- **Options button:** Displays the Options window, which reflects the most recent operating environment.
- **Help button**: Displays the HTML version of this manual.
- **Exit button:** Closes the Path Management window.

6.2.2 Tree Frame

You use the tree frame to specify the range of path information to be displayed in the view frame. Figure 6.3 shows the tree frame.

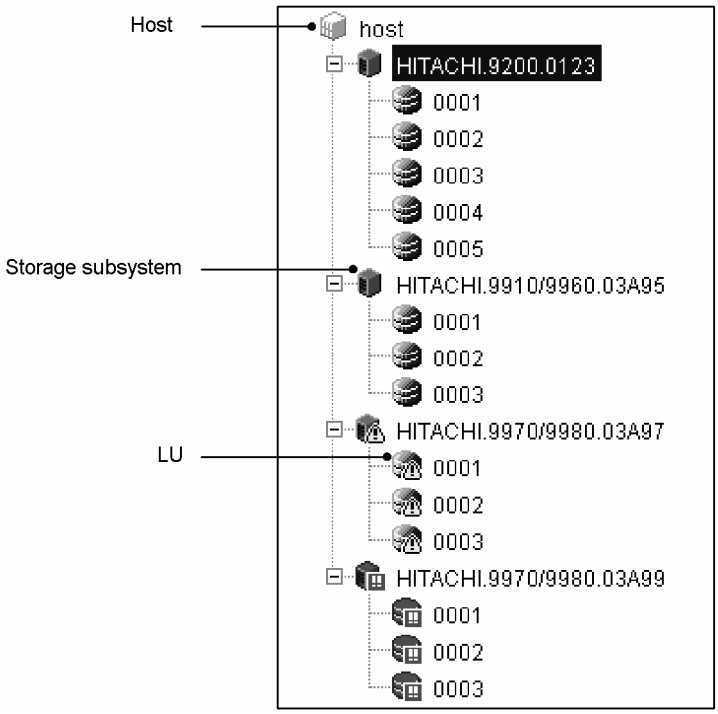


Figure 6.3 Tree Frame in Configuration View

The following describes the window components in the tree frame:

Host.

The tree frame displays an icon that indicates the host and the character string `host`.

In the tree frame of the **Configuration** view, an unselectable host icon is always displayed.

In the tree frame of the **Path List** view, selectable host icons are always displayed. When you select a host, the view frame of the **Path List** view displays the path information of all paths connected to the selected host.

Table 6.1 explains the host icons.

Table 6.1 Host Icons in Tree Frame of the Path Management Window

Icon	Icon Name	Explanation
	Host (selectable status)	Indicates a host that can be selected.
	Host (unselectable status)	Indicates a host that cannot be selected.

Systems: The tree frame displays icons that indicate storage systems and displays the storage-system names. A storage system name consists of the following three elements, separated by periods:

- **Vendor ID:** The name of the storage system vendor (for example, HITACHI).
- **Model ID:** Indicates the model name of the storage system (for example, 9200 indicates the Thunder 9200).
- **Serial number:** The serial number of the storage system (for example, 0123).

Table 6.2 shows the model IDs displayed in the tree frame, and the model names of corresponding storage systems supported by HDLM.

Table 6.2 Model IDs and Model Names of Corresponding Systems

Model ID	Model Name of Storage System
9200	Thunder 9200
9500V	Thunder 9500V Series
9910/9960	Lightning 9900 Series
9970/9980	Lightning 9900V Series
AMS	TagmaStore AMS
SVS	SVS
USP	■ Hitachi TagmaStore Universal Storage Platform 100 ■ Hitachi TagmaStore Universal Storage Platform 600 ■ Hitachi TagmaStore Universal Storage Platform 1100 ■ Hitachi TagmaStore Network Storage Controller NSC55

Model ID	Model Name of Storage System
USP_V	Hitachi Universal Storage Platform V
XP128	XP128
XP1024	XP1024
XP10000	XP10000
XP12000	XP12000
XP24000	XP24000

When you select a storage system, the view frame displays all of the paths connected to all of the LUs that can be accessed from that selected storage system.

When the Path Management window starts, a plus sign (+) is displayed on the left side of the system icons. When you click a plus sign (+) and switch to a minus sign (-), the tree frame displays the LUs that can be accessed from the storage system. The LUs are displayed in a hierarchy under the selected storage system.

If you select an LU and then switch to a plus sign (+) on the left side of the system icon, the systems connected to the selected LU become selected. Table 6.3 explains the icons that indicate storage systems.

Table 6.3 Storage System Icons the Tree Frame of the Path Management Window

Icon	Icon Name	Explanation
	Storage system	Indicates a storage system in which all of the paths connected to LUs are operating normally. This icon is displayed only when the following icon is displayed in the hierarchy under the storage system: **LU (all paths are online)**.
	Storage system (warning)	Indicates a storage system connected to an LU by a path where an error occurred. This icon is displayed only when more than one **LU (some paths are offline)** icon is displayed, and no **LU (no paths are online)** is displayed in the hierarchy under the storage system.
	Storage system (LU path error)	Indicates a storage system that contains an LU in which all paths are not working due to errors. This icon is displayed only when more than one **LU (no paths are online)** icon is displayed in the hierarchy under the storage system.

LUs: The tree frame displays icons that indicate LUs and displays the LU numbers. The tree frame displays only those LUs that can be accessed from the host. When you select an LU, the view frame displays all of the paths connected to the selected LU.

Table 6.4 explains the icons that indicate LUs.

Table 6.4 LU Icons in Tree Frame of the Path Management Window

Icon	Icon Name	Explanation
	LU (all paths are online)	Indicates an LU in which all paths are operating normally. Indicates an LU all of whose paths are in the Online status.
	LU (some paths are offline)	Indicates an LU in which some paths are operating normally. Indicates an LU that has a path in the Online status and also has a path in the Offline(C) or Offline(E) status.
	LU (no paths are online)	Indicates an LU in which all paths are not working. Indicates an LU that does not have a path in the Online status.

6.2.3 Configuration View in the Vview Frame

The view frame of the Path Management window displays one of the following two views:

- **Configuration** view
- **Path List** view

This subsection explains the window components in the **Configuration** view. If the content displayed for each storage system differs, this subsection explains the displayed contents individually.

The following figures show the **Configuration** view for each storage system.

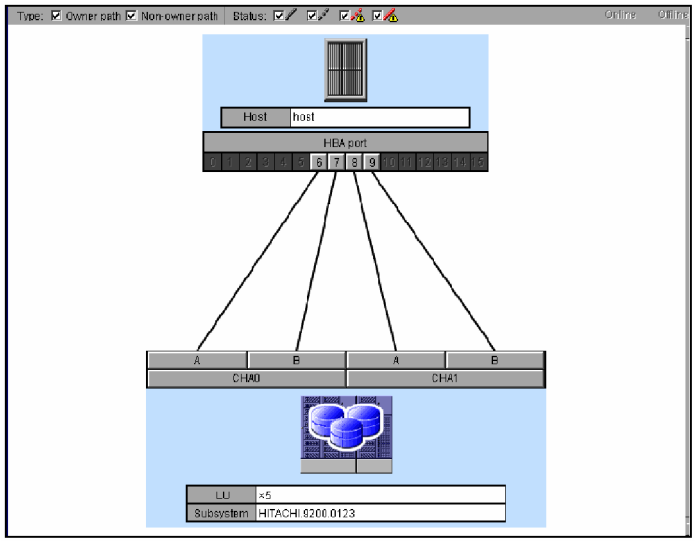


Figure 6.4 Configuration View: TagmaStore AMS/WMS Series (except the TagmaStore AMS 1000), Thunder 9500V Series (except Thunder 9580V) , or Thunder 9200

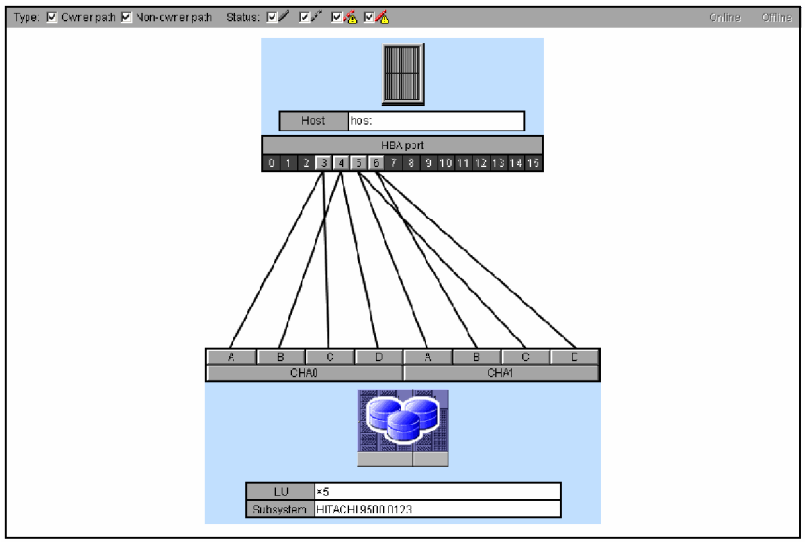


Figure 6.5 Configuration View (When Using the TagmaStore AMS 1000 or Thunder 9580V)

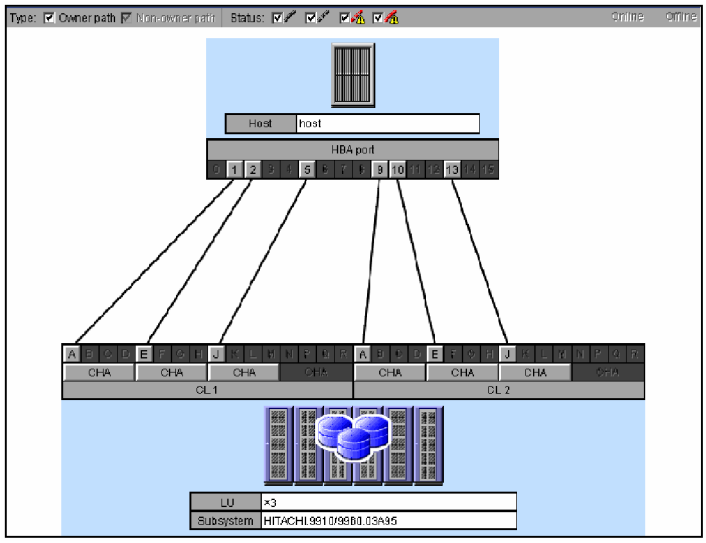


Figure 6.6 Configuration View: Lightning 9900 Series

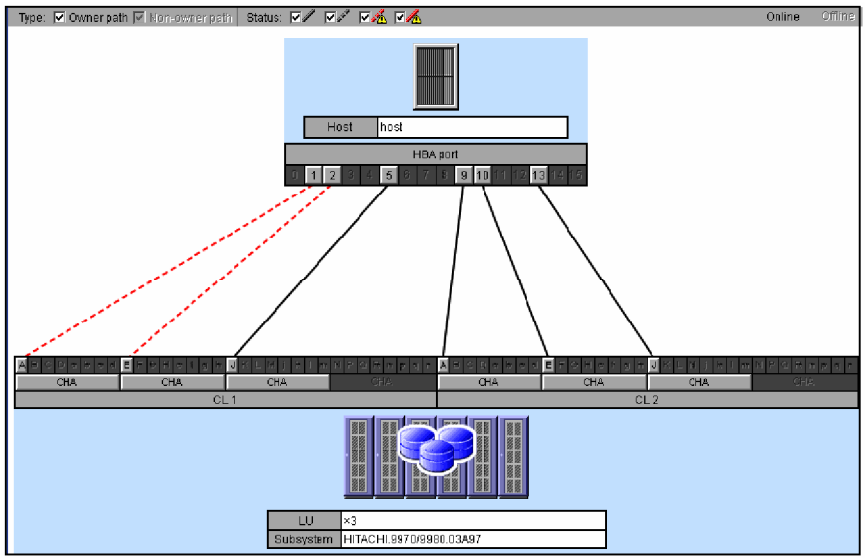


Figure 6.7 Configuration View: Lightning 9900V Series

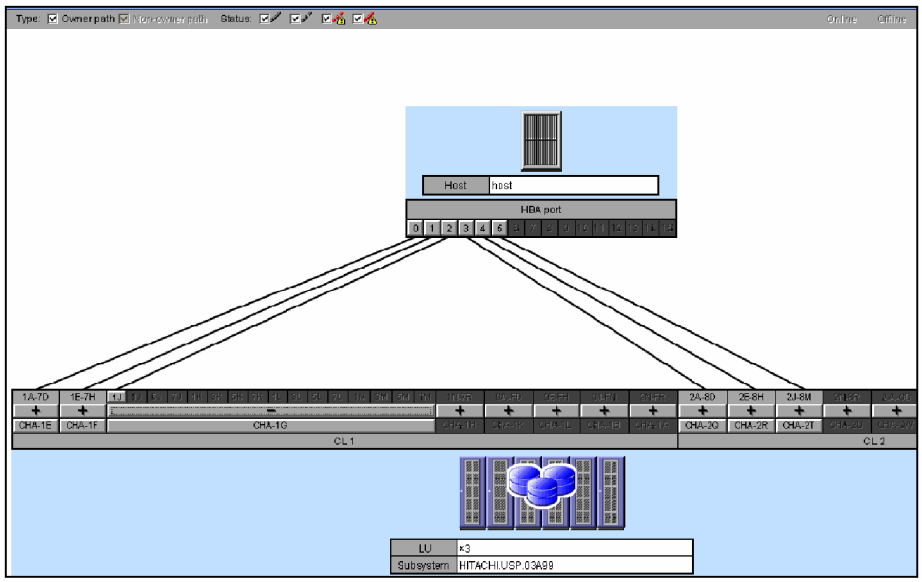


Figure 6.8 Configuration View: TagmaStore USP

When using the TagmaStore USP, the display format for the following items is different from that for other storage systems:

- A channel adapter number is assigned to each channel adapter. In Figure 6.8, these numbers are CHA-1E, CHA-1F, and so on.
- The port numbers for each channel adapter can be displayed in the minimized, or expanded modes.

  When the channel adapter ports are displayed in the minimized mode, all ports belonging to each channel adapter are displayed after being aggregated into one channel adapter port number. In Figure 6.8, these numbers are 1A-7D, 1E-7H, and so on.

  When the channel adapter ports are displayed in the expanded mode, 16 channel adapter port numbers for each channel adapter are displayed. In Figure 6.8, these numbers are 1J, 3J, and so on.

If you are using Universal Storage Platform V, the **Configuration** view is not displayed. In the view frame, the `KAPL02087-I` message is displayed. The following buttons and check boxes for the **Configuration** view are not displayed:

- **Online** button
- **Offline** button
- **Type** check box
- **Status** check box

The following describes each window component:

Type: In Type you can select the type of path to be displayed in the view frame. The selectable types are Owner path and Non-owner path.

- When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200

  By default, both the **Owner path** and **Non-owner** path check boxes are selected.

  The **Type** specification has priority over the **Status** specification. For example, if you select only the **Owner path** option in **Type**, the **Configuration** view will display only the owner paths whose statuses are selected in the **Status** check boxes.

  When you clear the **Owner path** check box or **Non-owner path** check box, the **Configuration** view narrows down the displayed paths accordingly.

  Note that the **Type** settings remain in effect even when you click the **Path List** tab and switch to the **Path List** view.

  Owner path check box: When you select **Owner path**, the **Configuration** view displays owner paths.

  Non-owner path check box: When you select **Non-owner path**, the **Configuration** view displays non-owner paths.

- When using the TagmaStore USP, Lightning 9900V Series, or Lightning 9900 Series

  In **Type** you can select the type of path to be displayed in the **Configuration** view. Since all paths are owner paths, only the Owner path check box is displayed as active.

The **Type** specification has priority over the **Status** specification. For example, if you clear the **Owner path** check box in **Type**, the **Configuration** view will not display those paths even if their statuses are selected in the **Status** check boxes.

Note that the **Type** settings of the **Configuration** view remain in effect even when you click the **Path List** tab and switch to the **Path List** view.

Owner Path check box

Select **Owner path** to display owner paths. Clear **Owner path** to hide all paths.

Status: You use the following four check boxes to select the status of the paths to be displayed. By default, all check boxes are selected.

When you clear a **Status** check box, the **Configuration** view narrows down the items displayed.

-  **Online path** check box: When you select this check box, the **Configuration** view displays the paths that have the Online or Online(P) status.
-  **Offline path** check box: When you select this check box, the **Configuration** view displays the paths that have the Offline(C) status.
-  **Offline (Error) path** check box: When you select this check box, the **Configuration** view displays the paths that have the Offline(E) or Offline(P) status.
-  **Online (Error) path** check box: When you select this check box, the **Configuration** view displays the paths that have the Online(E) or Online(EP) status. Note that the **Status** settings remain in effect even when you click the **Path List** tab and switch to the **Path List** view.

Online button: Clicking this button changes the status of a selected path (or paths) to Online. When no path is displayed in the **Configuration** view, or all the paths displayed in the **Configuration** view are in the Online status and no path is selected, the **Online** button is displayed as inactive.

If you click this button without first selecting a path, the **Configuration** view changes the status of all paths that are not already Online to Online.

If you attempt to change the status of multiple paths to Online but the status of one of those paths cannot be changed, the message KAPL02022-W appears. To ignore the path whose status cannot be changed and to continue processing, click the **OK** button. To stop processing, click the **Cancel** button.

Offline button: Clicking this button changes the status of a selected path (or paths) to Offline(C). In a cluster configuration, if a user selects a path whose status is `Online` and clicks the **Offline** button during reserve processing, the status of the selected path switches to `Online(P)`, which indicates that the offline processing is in a waiting-to-execute state. Despite this change in status, however, the appearance of the line that indicates the path status does not change. After the reserve processing finishes and the offline processing executes, the path status will switch to `Offline(C)`; however, the path information displayed in the **Configuration** view will not be automatically updated. To display the most recent path status, click the **Refresh** button.

When no path is displayed in the **Configuration** view, or no path is selected, the **Offline** button is displayed as inactive.

If you attempt to change the status of multiple paths to Offline(C) but one of those paths cannot be changed, the message KAPL02023-W appears. To ignore the path whose status cannot be changed and to continue processing, click the **OK** button. To stop processing, click the **Cancel** button.

Host: `host` is displayed.

HBA port button: Displays the HBA port number as the host port number (hexadecimal) converted into decimal. The HBA ports that are actually connected are usually displayed as active. If, however, the **Type** or **Status** check box specifies that a connected path is not to be displayed, the HBA port button is displayed as inactive. Placing the mouse pointer over an HBA port button displays a tool tip containing the HBA port number. Clicking an HBA port button displayed as active selects all the paths connected to that clicked HBA port.

Note: The paths are not displayed in the Configuration view when they are connected to an HBA port whose HBA port number is 16 or higher. To view or operate these paths, use the Path List view. For details about the **Path List** view, see section 6.2.4.

Paths: The paths that meet the conditions selected in the **Type** and **Status** check boxes are displayed. Lines are used to indicate the paths connecting a host and storage system.

Table 6.5 shows the appearance of lines that indicate paths, and the corresponding path status.

Placing the mouse pointer over a path displays a tool tip giving the path status (Online, Offline(C), Offline(E), Offline(E) (intermittent error), Online(E), or Online(E) (intermittent error)) and whether the path is an owner path or non-owner path.

When you click any of the following window components and select a path, the line is displayed thicker than before:

- Line that indicates a path
- HBA port button
- CHA port button
- CHA button

Table 6.5 Line Styles that Indicate Path and Path Status

Line Style	Path Status
(Black unbroken line)	Online or Online(P)
(Black broken line)	Offline(C)
(Red broken line)#	Offline(E) or Offline(P)
(Red unbroken line)#	Online(E) or Online(EP) When the LU dynamic deletion functionality is used, the path whose status is Online(E) is deleted. Therefore it is not displayed.

Line Style	Path Status
If the intermittent error monitoring functionality is enabled, the line that indicates the error path flashes when an intermittent error occurs in the path (The line lights for 3 seconds and then goes out for 0.2 seconds, repeatedly). Placing the mouse pointer over a path displays a tool tip giving the path status (Online, Offline(C), Offline(E), Offline(E) (intermittent error), Online(E), or Online(E) (intermittent error)) and whether the path is an owner path or non-owner path. When you click any of the following window components and select a path, the line is displayed thicker than before: ■ Line that indicates a path ■ HBA port button ■ CHA port button ■ CHA button	

– When using TagmaStore USP

When you display the CHA port in the minimized mode, one of the paths that has the most impact on the system is displayed when multiple paths connect to the CHA. The displayed paths are sorted in the following order of path status values:

1. Online(E) (intermittent error)
2. Online(E) or Online(EP)
3. Offline(E) (intermittent error)
4. Offline(E) or Offline(P)
5. Offline(C)
6. Online or Online(P)

CHA port button: These buttons display the CHA port number.

– When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200

The buttons for the channel adapter ports that are actually connected are usually displayed as active. If, however, the **Type** or **Status** check box specifies that a connected path is not to be displayed, the CHA port button is displayed as inactive.

Clicking a button displayed as active selects all the paths connected to that clicked channel adapter port. When using the TagmaStore AMS/WMS (except the TagmaStore AMS 1000) series, Thunder 9500V Series (except the Thunder 9580V), or Thunder 9200, two CHA port buttons are displayed per CHA button. When using the TagmaStore AMS 1000 or Thunder 9580V, four CHA port buttons are displayed per CHA button.

– When using the Lightning 9900V Series, or Lightning 9900 Series

These buttons display the channel adapter port number. The buttons for the channel adapter ports that are actually connected are usually displayed as active. If, however, the **Type** or **Status** check box specifies that a connected path is not to be displayed, the CHA port button is displayed as inactive.

Clicking a button displayed as active will select all the paths connected to that channel adapter port.

When using the Lightning 9900 Series, four of these buttons are displayed for each CHA button. When using the Lightning 9900V Series, eight of these buttons are displayed for each CHA button.

Placing the mouse pointer over these buttons displays a tool tip containing the channel adapter port number.

For the Lightning 9900V Series, the tool tips for the buttons **a** to **r** of **CL1** may display **3a** to **3r**, and the tool tips for the buttons **a** to **r** of **CL2** may display **4a** to **4r**.

- When using TagmaStore USP

  This button displays the CHA port number. The CHA port button is displayed in the minimized or the expanded mode for each CHA. Clicking the Minimize button or the Expand button switches the mode for displaying the CHA ports. The following explains the displays in the minimized mode and expanded mode.

  - Display in the minimized mode

    All the CHA ports belonging to a CHA (for example, CHA-1E) are integrated and displayed as one label. The button displays the first CHA port number and the last CHA port number, connected by a hyphen (-). For example, when a CHA contains CHA ports from 1A to 7D, the CHA port button shows **1A-7D**.

    If the connected paths are disabled by selecting the **Type** or **Status** check boxes, the CHA port button will also be disabled.

    You cannot select a path by clicking an active CHA port button.

  - Display in the expanded mode

    Each CHA port belonging to a CHA (for example, CHA-1E) is displayed in a button independently.

    If the connected paths are disabled by selecting the **Type** or **Status** check boxes, the corresponding CHA port button will also be disabled.

    Clicking an active button selects all paths connected to the selected CHA port.

Expand button and Minimize button

These buttons are displayed only when using TagmaStore USP. The buttons switch the mode for displaying the CHA ports of each CHA.

- Expand button ()

  The Expand button appears when the CHA ports are displayed in the minimized mode. When you click this button, it changes to the Minimize button and all the CHA port numbers belonging to the selected CHA appears. When you place the mouse pointer on the Expand button, **Expand** is displayed in the tool tip.

- Minimize button ()

  The Minimize button appears when the CHA ports are displayed in the expanded mode. When you click this button, it changes to the Expand button and one CHA port number that integrates all the CHA ports belonging to the selected CHA appears.

  When you place the mouse pointer on the Minimize button, **Minimize** is displayed in the tool tip.

When there is already a CHA port in the expanded mode and you switch another CHA port to the expanded mode, the first CHA port in the expanded mode is switched to the minimized mode. Only one CHA can be in the expanded mode.

The Expand or Minimize button is always active, whether or not the path connected to the CHA is displayed.

CHA button: This button indicates a channel adapter.

- When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200

  There are two buttons: **CHA0** and **CHA1**. If one or more of the channel adapter ports belonging to a CHA are displayed as active, the corresponding CHA button is displayed as active.

  If you selected an LU in the tree frame, HDLM displays whether the paths connected to the CHA are owner paths or non-owner paths based on the information of the paths connected to the LU. For example, when the path connected to **CHA0** is an owner path, the **CHA0** button displays **CHA0 (Owner Path)**. When the path connected to **CHA0** is a non-owner path, the **CHA0** button displays **CHA0 (Non-owner Path)**.

  If you selected a storage system in the tree frame, owner paths and non-owner paths are not distinguished so the label on the button remains **CHA0** or **CHA1** without change.

  Clicking a button displayed as active selects all the paths connected to the port that belongs to that clicked channel adapter.

- When using the Lightning 9900V Series, or Lightning 9900 Series

  The owner and non-owner paths are not distinguished, so no number is attached to **CHA**.

  If one or more of the channel adapter ports belonging to CHA are displayed as active, the **CHA** button is displayed as active.

  Clicking **CHA** selects all paths connected to the ports belonging to that channel adapter.

- When using TagmaStore USP

  A number is used to identify the cluster and channel adapter. The button displays the first CHA port number and the last CHA port number, connected by a hyphen (-). The channel adapter ports connected to the channel adapter are displayed as active when one or more is active. When clicked, all paths connected to ports belonging to the channel adapter are selected.

CL 1

This area is displayed only when using the Lightning 9900 series, Lightning 9900V series, or TagmaStore USP. This area displays the cluster number (CL 1) of the RAID device.

CL 2

This area is displayed only when using the Lightning 9900 series, Lightning 9900V series, or TagmaStore USP. This area displays the cluster number (CL 2) of the RAID device.

LU: If you selected a storage system in the tree frame, the box next to **LU** displays the number of LUs that can be accessed from the host and storage system. If you selected an LU in the tree frame, the box next to **LU** displays the LU number.

System: This box displays the name of the storage system that you selected in the tree frame. A storage system name consists of the following three elements, separated by periods:

- **Vendor ID:** The name of the storage system vendor (for example, HITACHI).
- **Model ID:** Indicates the model name of the storage system (for example, 9200 indicates the Thunder 9200).
- **Serial number:** The serial number of the storage system (for example, 0123).

Table 6.6 shows the model IDs displayed in the **Configuration** view, and the model names of corresponding storage systems supported by HDLM.

Table 6.6 Model IDs and Model Names of Corresponding Storage Systems

Model ID	Model Name of Storage System
9200	Thunder 9200
9500V	Thunder 9500V Series
9910/9960	Lightning 9900 Series
9970/9980	Lightning 9900V Series
AMS	TagmaStore AMS
SVS	SVS
USP	■ Hitachi TagmaStore Universal Storage Platform 100 ■ Hitachi TagmaStore Universal Storage Platform 600 ■ Hitachi TagmaStore Universal Storage Platform 1100 ■ Hitachi TagmaStore Network Storage Controller NSC55
XP128	XP128
XP1024	XP1024
XP10000	XP10000
XP12000	XP12000

6.2.4 Path List View in the View Frame

The view frame area of the Path Management window displays one of the following two views:

- **Configuration** view
- **Path List** view

This subsection explains the window components in the **Path List** view.

The **Path List** view of the Path Management window displays the configuration, status, and utilization of paths. Figure 6.9 shows the **Path List** view.

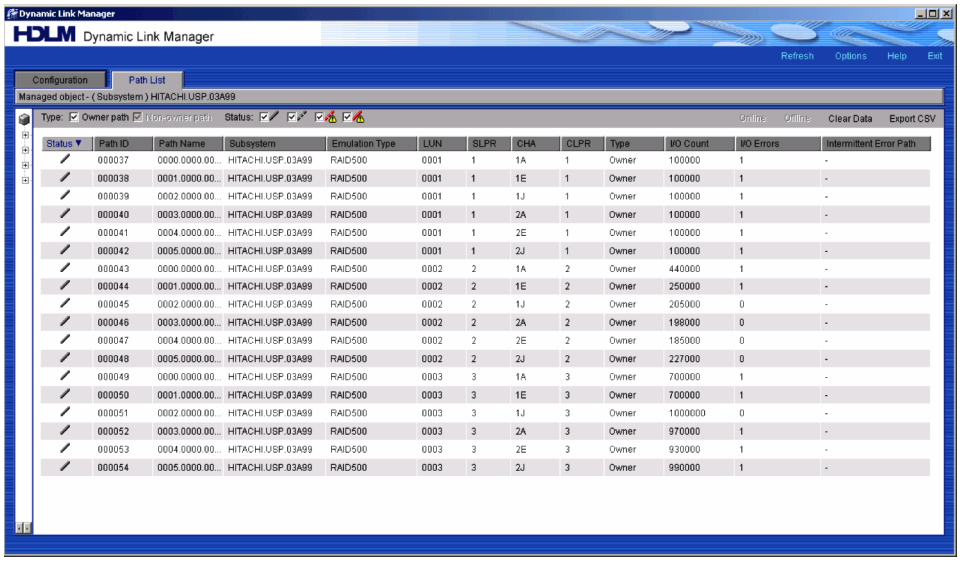


Figure 6.9 Path List View: TagmaStore USP, Lightning 9900V Series, or Lightning 9900 Series, TagmaStore USP, or Universal Storage Platform V)

For details about how to display path information on the **Path List** view and the details about the **Path List** view, see section 4.2.3.2.

The following describes each window component:

Type: In **Type** you can select the type of path to be displayed. The selectable types are **Owner path** and **Non-owner path**. When using the Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V, only the **Owner path** check box is displayed as active.

- **Owner path check box:** Select **Owner path** to display owner paths.
- **Non-owner path check box:** Select **Non-owner path** to display non-owner paths.

Status: You use the following four check boxes to select the status of the paths to be displayed. By default, all check boxes are selected. When you clear a **Status** check box, the **Path List** view narrows down the items displayed.

-  **Online path** check box: When you select this check box, the **Path List** view displays the paths that have the Online or Online(P) status.
-  **Offline path** check box: When you select this check box, the **Path List** view displays the paths that have the Offline(C) status.
-  **Offline (Error) path** check box: When you select this check box, the **Path List** view displays the paths that have the Offline(E) or Offline(P) status.
-  **Online (Error) path** check box: When you select this check box, the **Path List** view displays the paths that have the Online(E) or Online(EP) status.

  Note that the **Status** settings remain in effect even when you click the **Configuration** tab and switch to the **Configuration** view.

Online button: Clicking this button changes the status of a selected path (or paths) to Online. When no path is displayed in the **Path List** view, or all the paths displayed in the **Path List** view are in the Online status and no path is selected, the **Online** button is displayed as inactive.

If you click this button without first selecting a path, or if you click this button after selecting only a line for which no path information is displayed, the **Path List** view changes the status of all paths that are not already Online to Online.

If you attempt to change the status of multiple paths to Online but the status of one of those paths cannot be changed, the message KAPL02022-W appears. To ignore the path whose status cannot be changed and to continue processing, click the **OK** button. To stop processing, click the **Cancel** button.

Offline button: Clicking this button changes the status of a selected path (or paths) to Offline(C). In a cluster configuration, if a user selects a path whose status is Online and clicks the **Offline** button during reserve processing, the status of the selected path switches to Online(P), which indicates that the offline processing is in a waiting-to-execute state. Despite this change in status, however, the icon shown in the **Status** column does not change. After the reserve processing finishes and the offline processing executes, the path status will switch to Offline(C); however, the path information displayed in the **Path List** view will not be automatically updated. To display the most recent path status, click the **Refresh** button.

When no path is displayed in the **Path List** view, or no path is selected, the **Offline** button is displayed as inactive. If you attempt to change the status of multiple paths to Offline(C) but one of those paths cannot be changed, the message KAPL02023-W appears. To ignore the path whose status cannot be changed and to continue processing, click the **OK** button. To stop processing, click the **Cancel** button.

Clear Data button: This button sets the I/O count and the number of I/O errors to 0 for all paths managed by HDLM.

Export CSV button: This button exports, to a CSV file, the information for the paths displayed in the **Path List** view. The default name for the CSV file is *home-directory*/pathlist.csv. When no path is displayed in the **Path List** view, the **Export CSV** button is displayed as inactive.

Column headers: The column header for each column is a button. When you click the button, the path information is sorted using the information in the clicked header's column as the sorting key. A triangle is displayed on the far right of the header of the column used as the sorting key. Clicking the header button switches between sorting in ascending or descending order. When the sort is in ascending order, is displayed on the far right of the header. When the sort is in descending order, is displayed on the far right of the header.

Status: This column displays icons that indicate the path status. The meanings of the icons displayed in the status column are described below:

-  Indicates that the path status is Online or Online(P). This means the active status.
-  Indicates that the path status is Offline(C). This means the HDLM GUI or command-initiated offline status.
-  Indicates that the path status is Offline(E) or Offline(P). This means the failure-induced offline status. If the intermittent error monitoring functionality is enabled, the icon flashes when an intermittent error occurs in the path (The icon lights for 3 seconds and then goes out for 0.2 seconds, repeatedly).
-  Indicates that the path status is Online(E) or Online(EP). This means that an error occurred. If none of the paths accessing a device is in the Online status, one of the paths is changed to the Online(E) status. When the LU dynamic deletion functionality is used, the path whose status is Online(E) is deleted. Therefore it is not displayed.
- If the intermittent error monitoring functionality is enabled, the icon flashes when an intermittent error occurs in the path (The icon lights for 3 seconds and then goes out for 0.2 seconds, repeatedly).

  If you sort the path information in ascending order of the path status values, the sort order is as shown below. By default, the path information is sorted in descending order of path status values.

  - Online or Online(P)
  - Offline(C)
  - Offline(E) or Offline(P)
  - Offline(E) (intermittent error)
  - Online(E) or Online(EP)
  - Online(E) (intermittent error)

    Paths that are indicated by Offline(E), Offline(P), Online(E) or Online(EP) require corrective action. Take appropriate action according to section 5.3.

Path ID: This column displays the AutoPATH_ID as a decimal number. The AutoPATH_IDs are re-assigned every time the host is restarted.

Path Name: The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the paths that will be affected by the change. A path name consists of the following four elements, separated by periods:

- Host port number (hexadecimal number)
- Bus number (hexadecimal number)
- Target ID (hexadecimal number)
- Host LU number (hexadecimal number)

  Table 6.7 shows the elements of a path name and their representation in Windows.

Table 6.7 Elements of a Path Name

Element	Windows Representation
Host port number (hexadecimal) (***example:*** 0004, 0005)	SCSI port number
Bus number (***example:*** 0001)	SCSI bus number
Target ID (***example:*** 0000000000000000, 000000000000007A)	Target Id
Host LU number0001)	Logical Unit ID or LUN

The path name corresponds to the following information:

- Information shown in the Computer Management window.
- The information in the following registry: `HKEY_LOCAL_MACHINE\HARDWARE\DEVICEMAP\Scsi`

Note: When an FC connection is used, the target ID of a SCSI is determined based on the HBA configuration. For details on the target ID, see the relevant documentation, such as the HBA manual.

System: This column displays the names of the corresponding storage system to which each path is connected. This name allows you to specify the storage system to be accessed via a path. A storage system name consists of the following three elements, separated by periods:

- **Vendor ID:** The name of the storage system vendor (for example, HITACHI).
- **Model ID:** Indicates the model name of the storage system (for example, 9970/9980 indicates the Lightning 9900V Series).
- **Serial number:** The serial number of the storage system (for example, 03A97).

You can physically specify a storage system by referencing these elements of information from the storage system management program.

Table 6.8 shows the model IDs displayed in the **Path List** view, and the model names of corresponding storage systems supported by HDLM.

Table 6.8 Model IDs and Model Names of Corresponding Storage Systems

Model ID	Model Name of Storage System
9200	Thunder 9200
9500V	Thunder 9500V Series
9910/9960	Lightning 9900 Series
9970/9980	Lightning 9900V Series
AMS	TagmaStore AMS
SVS	SVS
USP	■ Hitachi TagmaStore Universal Storage Platform 100 ■ Hitachi TagmaStore Universal Storage Platform 600 ■ Hitachi TagmaStore Universal Storage Platform 1100 ■ Hitachi TagmaStore Network Storage Controller NSC55
USP_V	Hitachi Universal Storage Platform V
XP128	XP128
XP1024	XP1024
XP10000	XP10000
XP12000	XP12000
XP24000	XP24000

Emulation Type: When using the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200, this column displays the product ID of the storage systems. When using the Lightning 9900V Series, or Lightning 9900 Series, TagmaStore USP, or Universal Storage Platform V this column displays the emulation type of the storage systems. For command devices, "**-CM**" is added to the end of the product ID or the emulation type of the storage system (for example, DF600F-CM).

LUN: This column displays the LU numbers within the storage system. This number combined with the storage system name (indicated in **System**) identifies the LU that is accessed by a path. In the case of the Lightning 9900V Series, Lightning 9900 Series, TagmaStore USP, or Universal Storage Platform V the first two characters of the LUN indicate the CU (Control Unit) number, and the last two characters indicate the internal LU number within the CU. In the case of the TagmaStore AMS/WMS series, Thunder 9500V Series, or Thunder 9200 Series, the entire LUN is the internal LU number within the storage system. You can physically specify an LU by referencing the LUN from the storage system management program.

SLPR: This column displays the SLPR number to which the LU belongs. A decimal value from 0 to 31 is displayed. If the target LU exists in a storage system where storage logical partition functionality is not supported, a hyphen (-) is displayed.

CHA: This column displays the port numbers of the channel adapter. This number identifies the CHA that is mounted on the storage system. You can physically specify a CHA by referencing this number from the storage system management program.

CLPR: This column displays the CLPR number to which the CHA belongs. A decimal value from 0 to 31 is displayed. Note that a hyphen (-) is displayed if the following items are subject to display:

- CHA ports in the storage system that do not support cache logical partition functionality
- Paths connected to the Snapshot Image of the Copy-on-write Snapshot of the TagmaStore AMS/WMS series

Type: This column displays the attributes of paths. **Owner** is displayed for an owner path, and **Non-owner** is displayed for a non-owner path. If the Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V is being used, only **Owner** is displayed.

I/O Count: This column displays the total number (in decimal format) of I/O operations for the path. To reset the I/O count value to zero, click the **Data Clear** button. Clicking the **Data Clear** button also resets the I/O error count value to zero.

I/O Errors: This column displays the total number (in decimal format) of I/O errors for the path. To reset the I/O error count value to zero, click the **Data Clear** button. Clicking the **Data Clear** button also resets the I/O count value to zero.

Intermittent Error Path: Information about intermittent errors is displayed. One of the following values is displayed for each path:

- A - symbol indicates that intermittent error monitoring is not in effect, or the time is outside the period during which intermittent errors are monitored.
- A value of at least 0 indicates the number of errors that occurred during intermittent error monitoring.
- A * symbol indicates that an intermittent error is occurring in the path, and that the path is excluded from being subject to automatic failback.

A hyphen (-) is displayed when the HDLM manager of the host is not running.

To select paths on which you want to perform an operation, use any of the following methods:

- To select one line only, you can click the line that displays the information for the path you want to perform an operation on.
- To select a range of lines, you can click the top and the bottom lines of the desired range while pressing the **Shift** key.
- To select multiple lines, you can click the desired lines while pressing the **Ctrl** key.
- To select a range of lines, you can drag the mouse over the lines.

  Note that some paths might remain unselected depending on the speed of your mouse drag.

To release selection of a path, use either of the following methods:

- To release all selected lines, click an empty line.
- To release the selection of one line, click the line while pressing the **Ctrl** key.

6.3 Options Window

In the Options window, you can do the following:

- View the HDLM operating environment.
- Set the HDLM operating environment.

For details on how to view or set up the HDLM operating environment, see section 4.2.8.

Figure 6.10 shows the Options window.

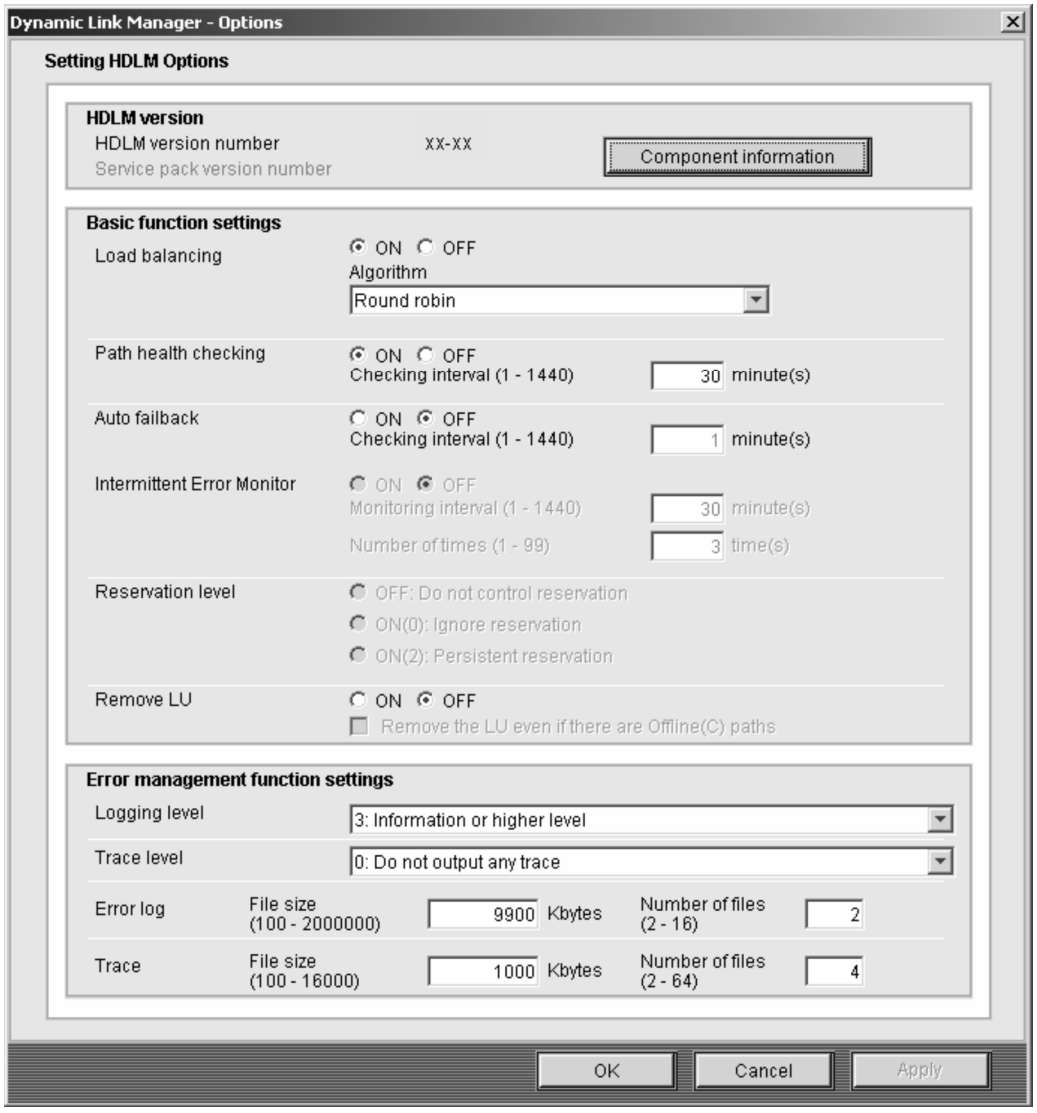


Figure 6.10 Options Window

Table 6.9 describes the default value and recommended value for each item displayed in the Options window.

Table 6.9 Default and Recommended Values for Items Displayed in the Options Window

Displayed Item	Default Value	Recommended Value
Load balancing	**ON** **Algorithm** is **Round robin**	**ON** The recommended setting for the algorithm depends on the operating environment.
Path health checking	**ON** The checking interval is 30 minutes.	**ON** The recommended checking interval depends on the operating environment.
Auto failback	**OFF**	**OFF**
Intermittent Error Monitor	**OFF**	**OFF**
Reservation level	(Not specifiable)	(Not specifiable)
Remove LU	**OFF**	The recommended value depends on the operating environment.
Logging level	**3: Information or higher level**	**3: Information or higher level**
Trace level	**0**: Do not output any trace	**0**: Do not output any trace
File size (for **Error log**)	**9900** (KB)	**9900** (KB)
Number of files (for **Error log**)	**2**	**2**
File size (for **Trace**)	**1000** (KB)	**1000** (KB)
Number of files (for **Trace**)	**4**	**4**

The following explains the window components in the Options window.

HDLM version

- **HDLM version number**: This area displays the version number of the HDLM.
- **Service pack version number**: This area displays the version number of the HDLM SP. If no SP was installed, this area remains blank.

Component information button: Clicking this button displays the HDLM Component Information dialog box. Figure 6.11 shows the HDLM Component Information dialog box.

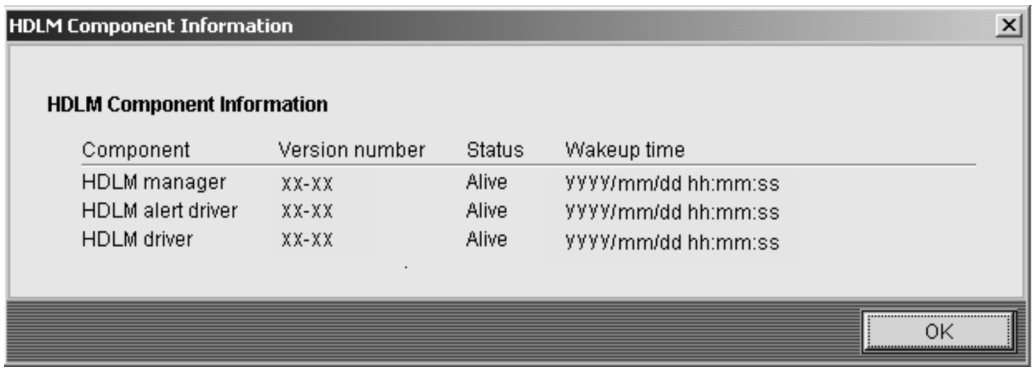


Figure 6.11 HDLM Component Information Dialog Box

Table 6.10 lists and describes the items displayed in the HDLM Component Information dialog box.

Table 6.10 Items Displayed in the HDLM Component Information Dialog Box

Item	Description
Component	HDLM component
Version number	Version number of the component
Status	Status of the component: **Alive**: Normal **Dead**: Stopped
Wakeup time	Time the component was started

Clicking the **OK** button closes the HDLM Component Information dialog box.

Basic function settings:

In this area, you can set whether to use load balancing, path health checking, automatic failback, intermittent error monitoring, and LU dynamic deletion functionality.

Load balancing

Specify whether or not the load balancing function is to be used. To use the function, select **ON**; otherwise, select **OFF**.

When **ON** is selected, you must also select a load-balancing algorithm from the pull-down list box:

- **Round robin**
- **Extended round robin**

Path health checking

Specify whether or not the path health checking function is to be used. To use the function, select **ON**; otherwise, select **OFF**.

When **ON** is selected, you can specify the interval (in minutes) at which path health checks are performed. Specify a value from 1 to 1440 minutes depending on the user environment. The default is 30.

If you change the checking interval, the new interval takes effect immediately. If you shorten the checking interval and a path health check is already overdue according to the new checking interval (since the last path health check was completed), path health checking begins immediately.

Once a checking interval is set, it remains in effect even if the path health checking function is subsequently changed from **OFF** to **ON**. In such a case, path health checking begins when the specified checking interval elapses after the path health checking function setting was changed to **ON**.

Setting the path health checking function to **ON** provides advantages such as the detection of errors on paths on which I/O requests are not normally issued (such as non-owner paths of Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series; or paths of a standby host of a cluster system).

Auto failback

Specify whether or not the auto failback function is to be used.

To use the function, select **ON**; otherwise, select **OFF**.

When **ON** is selected, you can specify the interval (in minutes) at which the path status is checked. Specify a value from 1 to 1440 minutes. The default, which is also the recommended value, is 1. Set the value depending on system operations.

If the intermittent error monitoring is **ON** and the number of times that an error is to occur is set to a value of 2 or more, the following condition must be satisfied:

```
error-monitoring-interval >= checking-interval-for-automatic-failback x number-of-times-error-is-to-occur-during-intermittent-error-monitoring
```

If this condition is not satisfied, the KAPL02064-W message is output and an error occurs. In such a case, change any of the following settings; the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that an error is to occur.

When you set the number of times that an error is to occur to `1`, the above condition does not need to be satisfied.

If you change the checking interval, the new interval takes effect immediately. If you shorten the checking interval and a status check is already overdue on the basis of the new checking interval (since the last path status check was completed), path status checking begins immediately.

Once a checking interval is set, it remains in effect even if the auto failback function is subsequently changed from **OFF** to **ON**. In such a case, path status checking begins when the specified checking interval elapses since the auto failback function setting was changed to **ON**.

Table 6.11 shows the advantage and disadvantages of setting the auto failback function to **ON**.

Table 6.11 Advantage and Disadvantages of Setting the Auto Failback Function to ON

Advantage	Disadvantage
Paths where errors have occurred are activated automatically.	▪ A path that has been shut down intentionally (Offline(E)) by the user (such as for maintenance purposes) may be activated automatically. ▪ If there is a recurring failure in a storage system or on a path, I/O performance may become degraded because the path's status changes repeatedly between shutdown and active.#

#

To prevent an intermittent error from reducing I/O performance, we recommend that you also enable intermittent error monitoring when enabling automatic failback. Intermittent error monitoring can only be specified when automatic failback is enabled. For details about the relations of the settings for automatic failback and intermittent error monitoring, see Table 6.12.

Intermittent Error Monitor

Intermittent Error Monitor can only be specified when **Auto failback** is set to **ON**.

Specify whether or not intermittent error monitoring is to be used. To use this function, select **ON**; otherwise, select **OFF**. When you use automatic failback, we recommend that you set intermittent error monitoring to **ON** to prevent an intermittent error from reducing I/O performance.

When you set **Intermittent Error Monitor** to **ON**, you can specify the error monitoring interval and the number of times that an error is to occur. Specifiable values are as follows:

- Monitoring interval for intermittent errors (in minutes): from 1 to 1440
- Number of times the error is to occur: from 1 to 99

The system assumes that an intermittent error is occurring if the specified number of times that an error is to occur is reached during the monitoring interval (from the time that the monitoring interval starts, until the specified interval ends). A path that is assumed to have an intermittent error is excluded from automatic failback. Intermittent error monitoring starts when a path recovers from an error through automatic failback. Monitoring is performed on individual paths.

When **Intermittent Error Monitor** is set to **ON**, by default the monitoring interval is 30 and the number of times that an error is to occur is 3.

When a value of 2 or more is specified in **Number of times**, the following condition must be satisfied:

```
error-monitoring-interval >= checking-interval-for-automatic-failback x number-of-
times-error-is-to-occur-during-intermittent-error-monitoring
```

If this condition is not satisfied, the KAPL02064-W message is output and an error occurs. In such a case, change any of the following settings; the checking interval for automatic failback, the intermittent error monitoring interval, or the number of times that an error is to occur.

If you specify `1` for the number of times that an error is to occur, the above condition does not need to be satisfied.

During intermittent error monitoring, if changes are made to the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the error count and the elapsed time measured since monitoring starts are set to 0. Then, monitoring starts with the new settings applied.

Outside the duration of intermittent error monitoring, if changes are made to the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the new settings take effect after the next time automatic failback succeeds. Because errors and the elapsed time are counted and measured while intermittent errors are monitored, those values do not change.

Once the monitoring interval and the number of times that an error is to occur are set, they remain in effect even if the intermittent error monitoring is subsequently changed from **OFF** to **ON**.

When you click the **Apply** button in the Options window while intermittent errors are being monitored, the error count and the elapsed time measured since monitoring starts are set to 0 even if you have not changed the settings, and monitoring continues.

When **Intermittent Error Monitor** is set to **ON** and automatic failback is set to **OFF**, intermittent error monitoring is disabled. If you return the automatic failback to **ON**, intermittent error monitoring is enabled.

Available operations for automatic failback and intermittent error monitoring depend on the function settings. Table 6.12 shows the relation between the settings and available operations for automatic failback and intermittent error monitoring.

Table 6.12 Relation Between the Setting and Available Operations for Automatic Failback and Intermittent Error Monitoring

Setting		Available Operation	Result of Operation
AFB	**IEM**		
ON	**ON**	Set AFB to **ON**.	▪ When a path is being monitored (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring restarts.#1 ▪ When a path is not being monitored (outside the period of conditional intermittent error monitoring), nothing changes.
		Change the AFB setting.	▪ AFB operates using new settings.#2 ▪ When a path is being monitored (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring restarts.#1 ▪ When a path is not being monitored (outside the period of conditional intermittent error monitoring), nothing changes.
		Set AFB to **OFF**.	▪ AFB and IEM are disabled. ▪ The error count, elapsed monitoring time, and information about paths not subject to automatic failback are completely cleared.
		Set IEM to **ON**.	▪ When a path is being monitored (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring restarts. ▪ When a path is not being monitored (outside the period of conditional intermittent error monitoring), nothing changes.
		Change the IEM settings.	▪ When a path is being monitored (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring restarts according to the changed conditions.#2 ▪ When a path is not being monitored (outside the period of conditional intermittent error monitoring), the IEM settings will take effect when the path is recovered from the error status by automatic failback.
		Set IEM to **OFF**.	▪ IEM is disabled.

			▪ The error count, elapsed monitoring time, and information about paths not subject to automatic failback are completely cleared.
	OFF	Set AFB to **ON**.	The operations of AFB and IEM do not change.
		Change the AFB setting.	AFB operates using new settings.
		Set AFB to **OFF**.	AFB is disabled.
		Set IEM to **ON**.	IEM is enabled.#2
OFF	**ON**#3	Set AFB to **ON**.	AFB and IEM are enabled.#2
		Set AFB to **OFF**.	The operations of AFB and IEM do not change.
	OFF	Set AFB to **ON**.	AFB is enabled.
		Set AFB to **OFF**.	The operations of AFB and IEM do not change.

Legend:

AFB: Automatic failback

IEM: Intermittent error monitoring

#1

If you want to change automatic failback settings but you do not want to reset the intermittent error monitoring settings, use the HDLM commands.

#2

When the conditions for settings values of the automatic failback check interval and the intermittent error monitoring are not satisfied, the KAPL02064-W error occurs. In this case, the intermittent error monitoring status does not change.

#3

Since automatic failback is **OFF**, intermittent error monitoring is disabled, and the settings for intermittent error monitoring are not specifiable.

When the HDLM version on the connected host is earlier than 5.4, intermittent error monitoring is not supported. So, the intermittent error monitoring setting is disabled and not selectable.

Reservation level

You cannot set the reservation level (the reservation control method for the LU).

Remove LU

When using the Remove LU functionality, set it to ON. When not using the Remove LU functionality, set it to OFF.

For details on the LU deletion functionality, see section 4.6.2. For details on the LU deletion function value, see Table 6.13.

Table 6.13 LU Deletion Function Values

Value		Description
OFF		The LU is not removed from HDLM management even if an error occurs in all the paths to the LU, all the paths to the LU are disconnected, or the LU is deleted. The status of the paths is Offline(E) and Online(E). This operation is the same as the operation in HDLM 5.1 or earlier. The off option is recommended when you want to use the same functionality as you use in HDLM 5.1 or earlier, without using the LU deletion functionality.
ON	The **Remove the LU even if there are Offline(C) paths** option is set to OFF.	The LU is removed from HDLM management when all the paths to the LU are disconnected. However, if an Offline(C) path is included in the disconnected paths, the LU is not deleted from HDLM management. The deleted LU is restored when it is recovered from the physical failure and the disk is re-scanned.
	The **Remove the LU even if there are Offline(C) paths** option is set to ON.	The LU is removed from HDLM management when all the paths to the LU are disconnected, even when an Offline(C) path is included. The removed LU is restored when it is recovered from the physical failure and the disk is re-scanned.

Error management functions settings:

In this area, you set items for the error management functions.

Logging level

From the pull-down list box, select the desired level of error information that is to be collected in the error log.

- **0: Do not collect an error log**
- **1: Error or higher level**
- **2: Warning or higher level**
- **3: Information or higher level**
- **4: Information or higher level (including maintenance information)**

As the set value becomes larger, the amount of log information to be output increases. As the amount of log information to be output increases, the amount of time until the old error log file is overwritten decreases.

The error log collection level can be set for the following log files:

Log files for the HDLM manager

`dlmmgr`*n*`.log` (*n* indicates a file number from `1` to `16`)

Log files for the HDLM GUI

`dlmgui`*n*`.log` (*n* indicates a file number of `1` or `2`)

When the HDLM version on the host is earlier than 5.6, you can select 0 to 3.

Trace level

From the pull-down list box, select the desired trace output level. In the event of an error, you may need to set the trace level to 1 or higher and collect the log information again.

- **0: Do not output any trace**
- **1: Error information only**
- **2: Summary of program operation**
- **3: Details of program operation**
- **4: All information**

The amount of log information to be output increases as the value of the setting increases. As the amount of log information to be output increases, the amount of time before log information wraps around and existing information is overwritten becomes shorter.

A trace file in which a trace level can be set is `hdlmtr`*n*`.log` (*n* indicates a file number from `1` to `64`). If the HDLM version on the host is earlier than 5.6, a trace level can be set in `hntr2`*n*`.log` or `hntr`*n*`.log` (*n* indicates a file number from `1` to `16`).

File size (for **Error log**)

In this box, you set the size of the error log file (in kilobytes). Set a value between 100 and 2000000. You can set the file size for the HDLM manager log (`dlmmgr`*n*`.log` (*n* indicates a file number from `1` to `16`)) and the HDLM GUI log (`dlmgui`*n*`.log` (*n* indicates a file number of `1` or `2`)). The specifiable range for the file size of the HDLM GUI log is 100 to 9900. If you set a value of 9901 or more, 9900 is applied. The specified value is applied to the HDLM manager log, however, if the version of HDLM is a version earlier than 5.6, you must specify a value from 100 to 9900.

When all log files reach the specified size, the oldest error log file is overwritten by new log information.

You can collect an error log of up to 32000000KB (approximately 30GB) by specifying the log file size and the number of log files.

Number of files (for **Error log**)

In this box, you set the number of log files. Set a value from 2 to 16.

By specifying the log file size and the number of log files in combination, you can collect up to 32000000KB (approximately 30GB) of error logs in total.

You can set the number of files for only the HDLM manager log (`dlmmgr`*n*`.log` (*n* indicates a file number from `1` to `16`)). The number of files for the HDLM GUI log (`dlmgui`*n*`.log` (*n* indicates a file number of `1` or `2`)) is fixed at 2.

When the HDLM version on the host is earlier than 5.6, this box is disabled and you cannot set the number of log files.

File size (for **Trace**)

In this box, you set the size of the trace (in kilobytes). Set a value from 100 to 16000.

If you set a smaller value than the current one, an execution confirmation message KAPL02080-W is output and then the trace file is deleted. You can set the file size for the trace file hdlmtr*n*.log (*n* indicates a file number from 1 to 64). The trace files are fixed in length. Thus, even if the amount of written trace information is less than the setting file size, the size of each output trace file is always fixed. When all trace files are written by trace data, the oldest trace file is overwritten by new trace data.

By specifying the trace file size and number of trace files, you can collect up to 1024000KB of trace information in total.

When the HDLM version on the host is earlier than 5.6, this box is disabled and you cannot set the size.

Number of files (for **Trace**)

In this box, you set the number of trace files. Set a value from 2 to 64

If you set a smaller value than the current one, an execution confirmation message KAPL02080-W is output and then the trace file is deleted.

By specifying the trace file size and number of trace files, you can collect up to 1024000KB of trace information in total.

You can set the number of files for the trace file hdlmtr*n*.log (*n* indicates a file number from 1 to 64).

When the HDLM version on the host is earlier than 5.6, this box is disabled and you cannot set the number of trace files.

OK button: Clicking **OK** applies the settings in the Options window, and then the Options window closes.

Cancel button: Clicking **Cancel** cancels the settings in the Options window, and then the Options window closes.

Apply button: Clicking **Apply** applies the settings in the Options window, but the Options window does not close. When the Options window is opened, the **Apply** button is displayed as inactive. When the settings in the Options window are changed, the button becomes active. After applying the settings, the **Apply** button becomes inactive again. If you change the settings for the error log file size, the changed value is only applied to the HDLM GUI log (dlmgui*n*.log (*n* indicates a file number of 1 or 2)) when HDLM GUI is restarted.

Chapter 7 Command Reference

This chapter describes the HDLM command (`dlnkmgr`) and its operations. Subsections include:

- Overview of the HDLM command (see section 7.1)
- The clear operation (see section 7.2)
- The help operation (see section 7.3)
- The offline operation (see section 7.4)
- The online operation (see section 7.5)
- The set operation (see section 7.6)
- The view operation (see section 7.7)

7.1 Overview of the HDLM Command (dlnkmgr)

This section describes how to specify the HDLM command `dlnkmgr` and its subcommands (called *operations* in HDLM). Note that messages might refer to this command and the operations as the *HDLM command*.

Command format

Enter the command using the following format:

```
dlnkmgr operation-name [parameter [parameter-value]]
```

Command values include the following:

- The command name is `dlnkmgr`.
- The type of operation entered after `dlnkmgr` is *`operation-name`*.
- A value required for an operation is indicated by *`parameter`*.
- A value required for a parameter is indicated by *`parameter-value`*.

Operations of the dlnkmgr command

Table 7.1 shows the operations of `dlnkmgr` and their functions.

Table 7.1 Operations of the dlnkmgr Command

Operation	Functions
`clear`	Initializes(0) the statistics (I/O count and I/O errors) of all paths managed by the HDLM system. For details, see section 7.2.
`help`	Displays the format of the operation used for HDLM. For details, see section 7.3.
`offline`	Places offline an online path or paths. For details, see section 7.4.
`online`	Places online an offline path or paths. For details, see section 7.5.
`set`	Sets the HDLM operating environment. For details, see section 7.6.
`view`	Displays HDLM program information, path information, LU information, and HDLM management-target device information. For details, see section 7.7.

Note: Execute the command as a member of the administrators group.

To specify a value containing a space in a parameter, enclose the entire value in double quotes (").

7.2 The Clear Operation

The `dlnkmgr` command's `clear` operation clears the statistics (I/O count and I/O errors) of all paths that are managed by HDLM to the initial value.

7.2.1 Format

To set the path statistics to 0, use this command: `dlnkmgr clear -pdst [-s]`

To display the format of the clear operation, use this command: `dlnkmgr clear -help`

7.2.2 Parameters

To set the path statistics to 0, `-pdst` clears statistics (I/O count and I/O errors) of all paths managed by HDLM to the initial value (0).

Example:

```
>dlnkmgr clear -pdst
KAPL01049-I Would you like to execute the operation? Operation name = clear [y/n]:y
KAPL01001-I The HDLM command completed normally. Operation name = clear, completion
time = yyyy/mm/dd hh:mm:ss
>
```

To execute the command without displaying a message asking for confirmation from the user, specify the `-s` parameter. This will allow you to skip the response to the confirmation message. For example, you want to execute the command in a shell script or batch file.

Example:

```
>dlnkmgr clear -pdst -s
KAPL01001-I The HDLM command completed normally. Operation name = clear, completion
time = yyyy/mm/dd hh:mm:ss
>
```

To display the format of the clear operation, specify the `-help` parameter. It displays the format of the `clear` operation.

Example:

```
>dlnkmgr clear -help
clear:
  Format
    dlnkmgr clear -pdst [-s]
KAPL01001-I The HDLM command completed normally. Operation name = clear, completion
time = yyyy/mm/dd hh:mm:ss
>
```

7.3 The Help Operation

The `dlnkmgr` command's `help` operation displays the list of operations available for the HDLM command, or the format of individual operations.

7.3.1 Format

The help operation's format is: `dlnkmgr help [operation-name] [operation-name] ...`

7.3.2 Parameters

operation-name

Specify the name of the HDLM command operation whose format you want to know. You can specify one of the following operation names:

- `clear`
- `help`
- `online`
- `offline`
- `set`
- `view`

If you do not specify any operation names, the `help` operation displays the names of all operations available for the HDLM command.

Examples

Example 1: The following example shows how to display the names of all the operations available in the HDLM command.

```
>dlnkmgr help
dlnkmgr:
  Format
    dlnkmgr { clear | help | offline | online | set | view }
KAPL01001-I The HDLM command completed normally. Operation name = help, completion
time = yyyy/mm/dd hh:mm:ss
>
```

Example 2: The following example shows how to display the formats of multiple operations.

```
>dlnkmgr help online offline help
online:
  Format
    dlnkmgr online [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr online [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr online [-path] [-pathid AutoPATH_ID] [-s]
  Valid value
    AutoPATH_ID    { 000000 - 999999 }(Decimal)
offline:
  Format
    dlnkmgr offline [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr offline [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -pathid AutoPATH_ID [-s]
  Valid value
    AutoPATH_ID    { 000000 - 999999 }(Decimal)
help:
  Format
    dlnkmgr help { clear | offline | online | set | view }
KAPL01001-I The HDLM command completed normally. Operation name = help, completion
time = yyyy/mm/dd hh:mm:ss
>
```

Example 3: The following example shows how to display the operation names that can be specified by the `help` operation.

```
>dlnkmgr help help
help:
  Format
    dlnkmgr help { clear | offline | online | set | view }
KAPL01001-I The HDLM command completed normally. Operation name = help, completion
time = yyyy/mm/dd hh:mm:ss
>
```

7.4 The Offline Operation

The dlnkmgr command's offline operation places online paths offline. Specify the paths you want to place offline by specifying a HBA port or channel adapter port to which the target paths are connected, or by specifying a single path.

The last path accessing each LU cannot be placed offline.

Placing too many paths offline may prevent path switching if an error occurs. Before placing a path offline, use the view operation to check how many online paths remain. For details about the view operation, see section 7.7.

In a cluster configuration, an offline operation requested during reserve processing is put into the waiting-to-execute state (Online(P), Online(EP), or Offline(P)), and does not execute until the reserve processing finishes.

7.4.1 Format

To place the path offline:

```
dlnkmgr offline
[-path]
{-hba host-port-number.bus-number
|-cha -pathid AutoPATH_ID
|-pathid AutoPATH_ID}
[-s]
```

To display the format of the offline operation:

```
dlnkmgr offline -help
```

7.4.2 Parameters

To place the path offline, the -path parameter indicates that the target of the operation is a path or paths managed by HDLM. This parameter is optional because the offline operation is only effective on paths. You must specify the target path in a subsequent parameter: -hba, -cha, or -pathid.

To place offline, at one time, all paths that pass through a specific HBA port, use -hba *host-port-number.bus-number*. The command will place offline all paths connected to the HBA port that has the specified host port number and bus number. Specify the host port number and bus number of the target HBA port: the numbers are found in the PathName field displayed using the view operation. Enter a period between these two parameter values. For details about the view operation, see section 7.7. Leading zeros of each parameter value can be omitted; however, when the host port number or bus number of the target HBA port is 0000, enter 0000 or 0 for the corresponding parameter value. The following example shows how to place offline all paths connected to the HBA port whose host port number is 0001 and bus number is 0001.

```
>dlnkmgr offline -hba 1.1
KAPL01055-I All the paths which pass the specified HBA will be changed to the
Offline(C) status. Is this OK? [y/n]:y
KAPL01056-I If you are sure that there would be no problem when all the paths which
pass the specified HBA are placed in the Offline(C) status, enter y.  Otherwise,
enter n. [y/n]:y
KAPL01061-I 3 path(s) were successfully placed offline(C). 0 path(s) could not be
placed offline(C). Operation name = offline
>
```

To place offline, at one time, all paths that pass through a specific channel adapter port, use `-cha -pathid` *`AutoPATH_ID`*. The command will place offline all paths that pass through the channel adapter port to which the path with the specified AutoPATH_ID is connected. You can specify this parameter only when the HDLM management-target device is the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V. Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see section 7.7. Leading zeros can be omitted (`000001` and `1` indicate the same *`AutoPATH_ID`*); however, when the target AutoPATH_ID is `000000`, enter `000000` or `0` for the parameter value. AutoPATH_IDs are re-assigned every time the host is restarted. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `offline` operation. The following example shows how to place offline all paths connected to the channel adapter port `0A`. In this example, a path whose AutoPATH_ID is `000001` is connected to the target channel adapter port.

```
>dlnkmgr offline -cha -pathid 000001
KAPL01055-I All the paths which pass the specified CHA port will be changed to the
Offline(C) status. Is this OK? [y/n]:y
KAPL01056-I If you are sure that there would be no problem when all the paths which
pass the specified CHA port are placed in the Offline(C) status, enter y.  Otherwise,
enter n. [y/n]: y
KAPL01061-I 2 path(s) were successfully placed offline(C). 0 path(s) could not be
placed offline(C). Operation name = offline
>
```

To place a single path offline, use `-pathid` *`AutoPATH_ID`*. Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see section 7.7. Leading zeros can be omitted(`000001` and `1` indicate the same *`AutoPATH_ID`*); however, when the target AutoPATH_ID is `000000`, enter `000000` or `0` for the parameter value. AutoPATH_IDs are re-assigned every time the host is restarted. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `offline` operation.

To execute the command without displaying the message asking for confirmation of command execution, use `-s`. For example, when you want to execute the command in a shell script or batch file. The following example shows how to place a path, whose AutoPATH_ID is `000001`, offline without asking for confirmation of command execution from the user.

```
>dlnkmgr offline -pathid 1 -s
KAPL01061-I 1 path(s) were successfully placed offline. 0 path(s) could not be placed
offline. Operation name = offline
>
```

To display the format of the offline operation, use -help. The following example shows how to display the format of the offline operation:

```
>dlnkmgr offline -help
offline:
  Format
    dlnkmgr offline [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr offline [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -pathid AutoPATH_ID [-s]
  Valid value
    AutoPATH_ID     { 000000 - 999999 }(Decimal)
KAPL01001-I The HDLM command completed normally. Operation name = offline, completion
time = yyyy/mm/dd hh:mm:ss
>
```

Reference

Using the view operation together with Windows commands enables you to filter the path information listed for a specific HBA port or channel adapter port. For details about the view operation, see section 7.7.

We recommend that you use the following command and verify the information on the target paths before you execute the offline operation to place offline all paths connected to a specific HBA port or channel adapter port.

The following example shows how to filter and display the information on all paths that pass through the HBA port whose host port number is 0004 and bus number is 0001.

```
>dlnkmgr view -path | find "0004.0001"
```

The above commands will display information on all the paths that pass through the specified HBA port.

The following example shows how to filter and display the information on all paths that pass through the channel adapter port 0A of the Thunder 9500V Series.

```
>dlnkmgr view -path -stname | find "9500V" | find "0A"
```

The above commands will display information pertaining to only those paths that pass through the specified channel adapter port.

Note: When the LU dynamic deletion functionality is used, a path might be deleted due to an error such as a path error. In this case, when you attempt to change the path status, an error occurs. Confirm that the path of which you attempt to change the status has been deleted, and then take actions for the path error. For details, see section 4.6.2.

7.5 The Online Operation

The dlnkmgr command's online operation places offline paths online. You can specify the paths you want to place online by specifying a HBA port or channel adapter port to which the target paths are connected, or by specifying a single path.

7.5.1 Format

To place the path online:

```
dlnkmgr online
[-path]
[-hba host-port-number.bus-number
|-cha -pathid AutoPATH_ID
|-pathid AutoPATH_ID]
[-s]
```

To display the format of the online operation:

```
dlnkmgr online -help
```

7.5.2 Parameters

To place the path online, -path indicates that the target of the operation is a path managed by HDLM. This parameter is optional because the online operation is only effective on paths. You can specify the target path in a subsequent parameter: -hba, -cha, or -pathid. If you do not specify any of these parameters, the command places all the offline paths online. If there is a path that cannot be placed online, a message asks whether you would like to continue processing. To ignore the offline path that cannot be placed online and to continue processing, enter y. To stop the processing, enter n.

To place online, at one time, all paths that pass through a specific HBA port, use -hba *host-port-number.bus-number*. The command will place online all paths connected to the HBA port with the specified host port number and bus number. Specify the host port number and bus number of the target HBA port: the numbers are found in the PathName field displayed using the view operation. Enter a period between these two parameter values. For details about the view operation, see section 7.7. Leading zeros of each parameter value can be omitted; however, when the host port number or bus number of the target HBA port is 0000, enter 0000 or 0 for the corresponding parameter value. The following example shows how to place online all paths connected to an HBA port whose host port number is 0001 and bus number is 0001.

```
>dlnkmgr online -hba 1.1
KAPL01057-I All the paths which pass the specified HBA will be changed to the Online
status. Is this OK? [y/n]:y
KAPL01061-I 3 path(s) were successfully placed online. 0 path(s) could not be placed
online. Operation name = online
>
```

To place online, at one time, all paths that pass through a specific channel adapter port, use `-cha -pathid` *`AutoPATH_ID`*. The command will place online all paths that pass through the channel adapter port to which the path with the specified AutoPATH_ID is connected. You can specify this parameter only when the HDLM management-target device is the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V

Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see section 7.7. Leading zeros can be omitted (`000001` and `1` indicate the same *`AutoPATH_ID`*); however, when the target AutoPATH_ID is `000000`, enter `000000` or `0` for the parameter value.

AutoPATH_IDs are re-assigned every time the host is restarted. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `online` operation. The following example shows how to place online the paths connected to the channel adapter port `0A`. In this example, a path whose AutoPATH_ID is `000002` is connected to the target channel adapter port.

```
>dlnkmgr online -cha -pathid 000002
KAPL01057-I All the paths which pass the specified CHA port will be changed to the
Online status. Is this OK? [y/n]:y
KAPL01061-I 2 path(s) were successfully placed online. 0 path(s) could not be placed
online. Operation name = online
>
```

To place a single path online, use `-pathid` *`AutoPATH_ID`*. Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see section 7.7. Leading zeros can be omitted (`000001` and `1` indicate the same *`AutoPATH_ID`*); however, when the target AutoPATH_ID is `000000`, enter `000000` or `0` for the parameter value. AutoPATH_IDs are re-assigned every time the host is restarted. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `online` operation.

To execute the command without displaying the message asking for confirmation of command execution, use `-s`. For example, use it when you want to execute the command in a shell script or batch file. The following example shows how to place a path, whose AutoPATH_ID is `000002`, online without asking for confirmation of command execution from the user.

```
>dlnkmgr online -pathid 2 -s
KAPL01061-I 1 path(s) were successfully placed online. 0 path(s) could not be placed
online. Operation name = online
>
```

To display the format of the online operation, use `-help`. The following example shows how to display the format of the `online` operation:

```
>dlnkmgr online -help
online:
  Format
    dlnkmgr online [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr online [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr online [-path] [-pathid AutoPATH_ID] [-s]
  Valid value
    AutoPATH_ID     { 000000 - 999999 }(Decimal)
```

```
KAPL01001-I The HDLM command completed normally. Operation name = online, completion
time = yyyy/mm/dd hh:mm:ss
>
```

Reference

Using the `view` operation together with Windows commands enables you to filter the path information listed for a specific HBA port or channel adapter port. For details about the `view` operation, see section 7.7.

We recommend that you use the following command and verify the information on the target paths before you execute the `online` operation to place `online` all paths connected to a specific HBA port or channel adapter port.

The following example shows how to filter and display the information on all paths that pass through the HBA port whose host port number is `0004` and bus number is `0001`.

```
>dlnkmgr view -path | find "0004.0001"
```

The above commands will display information on all the paths that pass through the specified HBA port.

The following example shows how to filter and display the information on all paths that pass through the channel adapter port `0A` of the Thunder 9500V Series.

```
>dlnkmgr view -path -stname | find "9500V" | find "0A"
```

The above commands will display information pertaining to only those paths that pass through the specified channel adapter port.

Note: When the LU dynamic deletion functionality is used, a path might be deleted due to an error such as a path error. In this case, when you attempt to change the path status, an error occurs. Confirm that the path of which you attempt to change the status has been deleted, and then take actions for the path error. For details, see section 4.6.2.

7.6 The Set Operation

The `dlnkmgr` command's `set` operation sets the HDLM operating environment.

7.6.1 Format

To set up the HDLM operating environment:

```
dlnkmgr set {-lb {on [-lbtype {rr|exrr}]|off}
   |-ellv error-log-collection-level
   |-elfs error-log-file-size
   |-elfn number-of-error-log-files
   |-systflv trace-level
   |-systfs trace-file-size
   |-systfn number-of-trace-files
   |-pchk {on [-intvl check-interval]|off}
   |-afb {on [-intvl check-interval]|off}}
   |-iem {on [-intvl error-monitoring-interval]
   [-iemnum number-of-times-error-is-to-occur] | off }
   |-lic
   |-rmlu {on [-force ]|off}}
   [-s]
```

To display the format of the set operation:

```
dlnkmgr set -help
```

7.6.2 Parameters

7.6.2.1 Setting Up the HDLM Operating Environment

Table 7.2 shows the defaults and recommended values for each setting. If you change the value of the `set` operation, the new value takes effect immediately.

Table 7.2 Default and Recommended Values

Item Name	Default Value	Recommended Setting
Load balancing	`on` Algorithm is round robin	`on` The recommended algorithm depends on the operating environment.
Error log collection level	`3`: Collect error information for the Information level and higher.	`3`: Collect error information for the Information level and higher.

Error log file size	9900 (KB)	9900 (KB)
Number of error log files	2	2
Trace level	0: Do not output any trace.	0: Do not output any trace.
Trace file size	1000 (KB)	1000 (KB)
Number of trace files	4	4
Path health checking	on	on The recommended checking interval depends on the operating environment.
Automatic failback	off	Off
Intermittent Error Monitor	off	Off
Remove LU	off	The recommended value depends on the operating environment.

The `-lb {on [-lbtype {rr|exrr}]|off}` value enables or disables load balancing.

- `on`: Enabled
- `off`: Disabled

In a cluster environment, the load balancing function is only available for Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V. In a non-cluster environment, the load balancing function is available for TagmaStore, Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, Universal Storage Platform V, and the EMC DMX series. The above-mentioned conditions are applied regardless of the settings for the EMC DMX series, EMC CX series, and HP EVA series. For example, in a cluster environment, the load balancing function is disabled even if it is set to `on` for the EMC DMX series. For details on the cluster software supported by HDLM, see section 2.12.

`-lbtype {rr|exrr}` value specifies the algorithm to be used for load balancing.

- `rr`: Round robin
- `exrr`: Extended round robin

The type of algorithm specified by the `-lbtype` parameter remains stored in the system, even when you disable load balancing function by specifying `-lb off`. Therefore, when you re-enable load balancing without specifying an algorithm, load balancing will be executed according to the setting stored in the system. When using MSCS, depending on the micro-program of the storage system, you may not be able to use the load balancing function. For more details, see the *hardware notes* provided with HDLM.

To specify the level of error information you want to collect for an error log, use `-ellv` *`error-log-collection-level`*. Log files in which a error log collection level can be set include:

- HDLM manager logs: `dlmmgr`*`n`*`.log` (*n* indicates a file number from `1` to `16`)
- HDLM GUI logs: `dlmgui`*`n`*`.log` (*n* indicates a file number of `1` or `2`)

Table 7.3 shows the values of the error log collection level. If an error occurs, you may have to set the error log collection level to 1 or higher to collect log information.

Table 7.3 Error Log Collection Level Values

Value	Description
0	Collects no error log.
1	Collects error information for the Error or higher level.
2	Collects error information for the Warning or higher level.
3	Collects error information for the Information or higher level.
4	Collects error information for the Information or higher level (including maintenance information).

As the amount of log information to be output increases, the amount of time before existing information is overwritten becomes shorter.

Example:

```
>dlnkmgr set -ellv 1
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y
KAPL01001-I The HDLM command completed normally. Operation name = set, completion
time = yyyy/mm/dd hh:mm:ss
>
```

To specify a value from 100 to 2000000 (kilobytes) for the size of the error log files, use `-elfs` *`error-log-file-size`*. The target log files for which a file size can be set are HDLM manager logs (`dlmmgr`*`n`*`.log` (*`n`* indicates a file number from `1` to `16`)) and HDLM GUI logs (`dlmguin.log` (*`n`* indicates a file number of `1` or `2`)). For HDLM GUI logs, the valid range of a file size is from 100 to 9900. If you specify a value of `9901` or more, `9900` is applied. The specified value is applied for HDLM manager logs.

When combined with the specification for the number of error log files, the maximum total size of error log files that can be collected is 32000000KB (approximately 30GB).

When the size of all log files in a log file group reaches a specified value, new log data overwrites existing log data (the oldest log file is overwritten first).

`-elfn` *`number-of error-log-files`*. Specify a value from 2 to 16. When combined with the specification for the error log file size, the maximum total size of error log files that can be collected is 32000000KB (approximately 30GB). The target log files for which the number of files can be set are HDLM manager logs (`dlmmgr`*`n`*`.log` (*`n`* indicates a file number from `1` to `16`)) only. For HDLM GUI logs (`dlmguin.log` (*`n`* indicates a file number of `1` or `2`)), the number of log files is fixed to `2`.

To specify the trace output level, use `-systflv` *`trace-level`*. The trace files for which trace levels can be set are `hdlmtr`*`n`*`.log` (*`n`* indicates a file number from `1` to `64`).

Table 7.4 shows the values of the trace level. The default is `0`. When an error occurs, we recommend that you set the value of the trace level to `1` or higher and re-collect log information. If an error occurs, you may have to set the trace level to 1 or higher to collect log information.

Table 7.4 Trace Level Values

Value	Description
0	Does not output any trace.
1	Only outputs error information.
2	Outputs a summary of program operation.
3	Outputs details of program operation.
4	Outputs all information.

The larger the trace level value, the larger the amount of log information that is output. As the amount of log information that is output increases, the amount of time before existing information is overwritten becomes shorter.

To specify the size of the trace file in kilobytes, use `-systfs` *`trace-file-size`*. Specify a value of `100` to `16000`. When combined with the specification for the number of trace files, the maximum total size of the trace files that can be collected is `1024000`KB. If a value smaller than the setting value is specified, an execution confirmation message KAPL01097-W is displayed and the trace file is once deleted.

The trace files for which a file size can be set are `hdlmtrn.log` (*`n`* indicates a file number from `1` to `64`). The trace files are fixed in length. Thus, even if the amount of written trace information is less than the setting file size, the size of each output trace file is always fixed. When trace data is written to all trace files, new trace data overwrites old trace data (the oldest file is overwritten first).

To specify the number of trace files, use `-systfn` *`number-of-trace-files`*. Specify a value of `2` to `64`. When combined with the specification for the trace file size, the maximum total size of the trace files that can be collected is `1024000`KB. If a value smaller than the setting value is specified, an execution confirmation message KAPL01097-W is displayed and the trace file is once deleted. The trace files for which the number of files can be set are `hdlmtr`*`n`*`.log` (*`n`* indicates a file number from `1` to `64`).

To enable or disable path health checking, use `-pchk {on [-intvl` *`checking-interval`*`]|off}`.

- `on`: Enabled
- `off`: Disabled

Path health checking checks the paths that have the Online status. For a standby host, or a host connected to the TagmaStore AMS/WMS series, Thunder 9200, or Thunder 9500V Series storage system, we recommend that you activate path health checking to enable detection of errors in paths where I/Os do not occur. When you specify `on`, specify the checking interval of path health checking by specifying the parameter immediately following `on`. If you do not specify a checking interval, path health checking is executed in the following interval:

- When the checking interval has not been specified before, every 30 minutes (default setting).
- When the checking interval has been specified before, the interval used in the last time.

The explanation for the following sub-parameter describes how to specify the checking interval.

To specify the checking interval between path health checks (in minutes), use `-intvl` *`checking-interval`*. Specify a value from 1 to 1440 minutes depending on the user environment. When you change the checking interval, the new setting takes effect immediately. When the checking interval is shortened and the checking interval after the change (from the end of the previous path health check) has already elapsed, the path health check will start immediately.

The path health check interval setting remains stored in the system even if you disable the function by changing the setting of path health checking to `off`. Therefore, when you re-enable path health checking and do not change the interval, path health checking is executed at the interval stored in the system.

To enable or disable automatic failback, use `-afb {on [-intvl` *`checking-interval`*`]|off}`.

- `on`: Enabled
- `off`: Disabled

Enabling automatic failback may automatically place online those paths that were intentionally placed offline (for example, paths placed offline for maintenance work).

If you want to prevent such paths from automatically being placed online, disable this function. When intermittent errors occur in paths or storage systems, path status alternates between the online and offline status frequently, so I/O performance might deteriorate.

Automatic failback is executed in the following paths:

- Path where an error occurred and for which the KAPL08022-E message was displayed.
- Path where an error occurred at the startup of the HDLM manager.

To prevent an intermittent error from deteriorating I/O performance, we recommend that you also enable intermittent error monitoring when enabling automatic failback. Intermittent error monitoring is specifiable only when automatic failback is enabled.

See Table 7.5 for the relationship between automatic failback and intermittent error monitoring.

When you specify `on`, specify the checking interval of path status by specifying the parameter immediately following `on`. If you do not specify a checking interval, path status is checked in the following interval:

- When the checking interval has not been specified before: Every minute (default setting).
- When the checking interval has been specified before: The interval used in the last time.

The explanation for the following sub-parameter describes how to specify the interval between path status checks.

To specify the interval between path status checks (in minutes), use `-intvl` *checking-interval*. Specify a value from 1 to 1440 minutes as appropriate for your operation environment.

If intermittent error monitoring is `on` and the number of times that the error is to occur is set to a value of 2 or more, the following condition must be satisfied:

error-monitoring-interval >= *checking-interval-for-automatic-failback* x *number-of-times-error-is-to-occur-during-intermittent-error-monitoring*

If this condition is not satisfied, the KAPL01080-W message is output and an error occurs. In such a case, change any of the following settings: the checking interval for automatic failback, the intermittent error monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to `1`, the above condition does not need to be satisfied.

When you change the error monitor interval while monitoring for an intermittent error is operating, the new setting takes effect immediately. When the checking interval is shortened and the checking interval after the change (from the end of the previous path status check) has already elapsed, the path status check will start immediately.

This setting remains stored in the system, even if you disable the function by changing the setting of automatic failback to `off`. Therefore, when you re-enable automatic failback and do not change the interval, path status checks are executed at the interval stored in the system.

When you upgrade from HDLM 3.0 or 3.1 to 5.0 or later, and the `-pchk` parameter was set to `on` in the previous version, the `-afb` parameter will be set to `on` in the new version. The value of the `-intvl` parameter will be set to the same value as the checking interval of the `-pchk` parameter.

To enable or disable intermittent error monitoring, use `-iem { on [-intvl` *error-monitoring-interval*`] [-iemnum` *number-of-times-error-is-to-occur*`] | off }`.

- `on`: Enabled
- `off`: Disabled

Intermittent error monitoring can be set only when automatic failback is set to `on`. When you use automatic failback, we recommend that you set intermittent error monitoring to `on` to prevent an intermittent error from reducing I/O performance.

If `on` is specified, in the subsequent parameters specify the intermittent error monitoring interval and the number of times that the error is to occur. The system assumes that an intermittent error is occurring if the specified number of times that the error is to occur is reached during the monitoring interval (from the time that the monitoring interval starts, until the specified interval ends). A path that is assumed to have an intermittent error is excluded from automatic failback. Intermittent error monitoring is performed on individual paths. Intermittent error monitoring starts when a path is recovered from the error by using automatic failback.

If you omit the intermittent error monitoring interval or the number of times that the error is to occur, each setting is specified as follows:

- When the intermittent error monitoring interval or the number of times that the error is to occur has not been specified before, the intermittent error monitoring interval is set to 30 minutes, and the number of times that the error is to occur is set to 3.
- When the intermittent error monitoring interval or the number of times that the error is to occur has been specified before, the values specified the last time are set.
- When a value of 2 or more is specified in number of times, the following condition must be satisfied:

  error-monitoring-interval >= *checking-interval-for-automatic-failback x number-of-times-error-is-to-occur-during-intermittent-error-monitoring*

  If this condition is not satisfied, the KAPL01080-W message is output and an error occurs. In such a case, change any of the following settings: the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that the error is to occur.
- When you set the number of times that the error is to occur to `1`, the above condition does not need to be satisfied.

The following sub-parameters specify the error monitoring interval and the number of times that the error is to occur (in order for the system to determine that an intermittent error is occurring).

To specify the monitoring interval for an intermittent error (in minutes), use `-intvl` *`error-monitoring-interval`*. Use a value from 1 to 1440. The default is `30`. During intermittent error monitoring, if changes are made in the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the error count and the elapsed time measured since monitoring starts are set to 0, and monitoring starts by using the new settings.

Outside the duration of intermittent error monitoring, if changes are made in the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the new settings take effect after the next time automatic failback succeeds. Because the errors and elapsed time are not counted or measured while intermittent errors are not monitored, those values do not change.

The monitoring interval specified in this parameter is stored even though specifying `-iem off` disables intermittent error monitoring. Therefore, when you re-enable intermittent error monitoring and the monitoring interval is not specified, error monitoring will be executed for the stored monitoring interval.

To specify the number of times the error is to occur, use `-iemnum` *`number-of-times-error-is-to-occur`*. Use a value from 1 to 99. The default is `3`.

During intermittent error monitoring, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, the number of errors and the time that has passed since intermittent error monitoring starts are reset to 0. Then, the changed setting takes effect and intermittent error monitoring starts.

Outside the duration of intermittent error monitoring, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, from the next time automatic failback finishes normally, the changed values takes effect. Outside the duration of intermittent error monitoring, the number of errors that determine an intermittent error is not counted and this value is not changed.

The number of times that the error is to occur specified in this parameter is stored even though specifying `-iem off` disables intermittent error monitoring. Therefore, when you re-enable intermittent error monitoring and the number of times is not specified, the error monitoring will be executed using the stored number of times.

When the `set -iem on` operation is executed during error monitoring, even if you do not change the conditions for intermittent error, the number of errors and the time that has passed since the error monitoring starts are reset to 0. Then intermittent error monitoring resumes with the changed settings.

If you set automatic failback to `off` while intermittent error monitoring is `on`, intermittent error monitoring becomes disabled. Note, however, that if you use the `view -sys` operation to display the HDLM functionality configuration, `Intermittent Error Monitor` shows `on`. When automatic failback is returned to `on`, intermittent error monitoring becomes enabled.

The executable operations for automatic failback and intermittent error monitoring depend on the setting status for those functions.

Table 7.5 shows the relationship between the setting status for automatic failback and intermittent error monitoring and the executable operations for those functions.

Table 7.5 Relationship Between Setting Status for Automatic Failback and Intermittent Error Monitoring and Executable Operations

Setting		Available Operation	Result of Operation
Automatic Failback	Intermittent Error Monitoring		
on	on	Set automatic failback to on.	The operations of automatic failback and intermittent error monitoring do not change.
		Change the automatic failback setting.	Automatic failback operates using new settings.[1]
		Set automatic failback to off.	■ Automatic failback and intermittent error monitoring are disabled. ■ The error count, elapsed monitoring time, and information about paths not subject to automatic failback are cleared.

Setting		Available Operation	Result of Operation
Automatic Failback	**Intermittent Error Monitoring**		
		Set intermittent error monitoring to `on`.	■ When a path is being monitored (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to `0`, and then intermittent error monitoring restarts. ■ When a path is not being monitored (outside the period of conditional intermittent error monitoring), nothing changes.
		Change the intermittent error monitoring settings.	■ When a path is being monitored (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring restarts according to the conditions for intermittent error after change.[1] ■ When a path is not being monitored (outside the period of conditional intermittent error monitoring), the intermittent error monitoring settings will take effect when the path is recovered from the error status by performing automatic failback.
		Set intermittent error monitoring to `off`.	■ Intermittent error monitoring is disabled. ■ The error count, elapsed monitoring time, and information about paths not subject to automatic failback are cleared.
	`off`	Set automatic failback to `on`.	The operations of automatic failback and intermittent error monitoring do not change.
		Change the automatic failback setting.	Automatic failback operates using new settings.
		Set automatic failback to `off`.	Automatic failback is disabled.
`on`	`off`	Set intermittent error monitoring to `on`.	Intermittent error monitoring is enabled.[1]
`off`	`on`[2]	Set automatic failback to `on`.	Automatic failback and intermittent error monitoring are enabled.[1]
		Set automatic failback to `off`.	The operations of automatic failback and intermittent error monitoring do not change.
	`off`	Set automatic failback to `on`.	Automatic failback is enabled.
		Set automatic failback to `off`.	The operations of automatic failback and intermittent error monitoring do not change.

[1]When this condition is not satisfied, the KAPL01080-W message is output and an error occurs. The status of the intermittent error monitoring does not change.

Setting		Available Operation	Result of Operation
Automatic Failback	**Intermittent Error Monitoring**		

[2]Since automatic failback is `off`, intermittent error monitoring is disabled. The following example shows how to enable monitoring of intermittent errors:
`>dlnkmgr set -iem on -intvl 20 -iemnum 2`
`KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y`
`KAPL01001-I The HDLM command completed normally. Operation name = set, completion time =` *yyyy/mm/dd hh:mm:ss*
`>`			

Specify the `-lic` option when a license is updated. The HDLM license is provided by a license key or a license key file. A license key file is a file that stores an HDLM license key. If you use a license key file, store the license key file named `hdlm license` directly under the Windows installation-destination, and then execute the `set -lic` operation. A message confirming that the license key has been registered is displayed, depending on the license key type described in the license key file. When a temporary license key or emergency license key has been registered, the expiration period is displayed (KAPL01071-I, KAPL01072-I).

If you do not use a license key file, when the `set -lic` operation is executed, a message (KAPL01068-I) asking the user to enter a license key appears. Enter the license key. A message confirming that the license key has been registered is displayed, depending on the license key type described in the license key file. When a temporary license key or emergency license key has been registered, the expiration period is displayed (KAPL01071-I, KAPL01072-I).

Table 7.6 lists the license key types.

Table 7.6 License Key Types

Type	Description
Permanent license key	Permanent licenses are valid for using HDLM in an ongoing basis.
Temporary license key*	The temporary license key is used temporarily, for example, when a user performs product evaluations. Temporary licenses are valid for only 120 days after installation. You cannot reuse a temporary license key.
Emergency license key	The emergency license key is used temporarily, for example, when issuing a permanent license key that is delayed for some reasons. Emergency licenses are valid for 30 days after they are entered. You cannot reuse an emergency license key.
A temporary license key cannot be installed by using the dlnkmgr `set` operation.	

The following example shows how to update the license key (when the license key file exists):

```
>dlnkmgr set -lic
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y
KAPL01071-I A permanent license was installed.
KAPL01001-I The HDLM command completed normally. Operation name = set, completion
time = yyyy/mm/dd hh:mm:ss
>
```

The following example shows how to update the license key (when the license key file does not exist).

```
>dlnkmgr set -lic
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y
KAPL01083-I There is no license key file. File name =Windows-installation-destination-
drive-name\hdlm_license
KAPL01068-I Enter a license key:*************
KAPL01071-I A permanent license was installed.
KAPL01001-I The HDLM command completed normally. Operation name = set, completion
time = yyyy/mm/dd hh:mm:ss
>
```

To enable or disable the LU dynamic deletion functionality, use `-rmlu { on [ -force ] | off }`.

- `on`: Enabled
- `off`: Disabled (the default)

The explanation for the following sub-parameter describes how to specify the LU dynamic deletion functionality.

To remove an LU from HDLM management, use `-force`. The LU is removed from HDLM management when all the paths to the LU are disconnected, even when an Offline(C) path is included. For details on the LU dynamic deletion functionality, see section 4.6.2.

Table 7.7 shows the values of the LU dynamic deletion functionality.

Table 7.7 Values for LU Dynamic Deletion Functionality

Value	Description
`off`	The LU is not removed from HDLM-management even if the error occurs in all the paths to the LU, all the paths to the LU are disconnected, or the LU is deleted. The status of the paths is Offline(E) and Online(E). This operation is as equal as the operation in HDLM 5.1 or earlier. The `off` option is recommended when you want to use the same functionality as you use in HDLM 5.1 or earlier, without using the LU dynamic deletion functionality.
`on`	The LU is removed from HDLM-management when all the paths to the LU are disconnected. However, if an Offline(C) path is included in the disconnected paths, the LU is not deleted from HDLM-management. The deleted LU is restored when it is recovered from the physical failure and the disk is re-scanned.
`on -force`	The LU is removed from HDLM management when all the paths to the LU are disconnected, even when an Offline(C) path is included. The removed LU is restored when it is recovered from the physical failure and the disk is re-scanned.

To execute the command without displaying the message asking for confirmation, use the `-s` parameter. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

To display the format of the set operation, use `-help`.

The following example shows how to display the format of the `set` operation.

```
>dlnkmgr set -help
set:
  Format
    dlnkmgr set { -lb on [ -lbtype { rr | exrr } ]
                | -lb off
                | -ellv ElogLevel
                | -elfs ElogFileSize
                | -elfn Number-Of-ElogFiles
                | -systflv TraceLevel
                | -systfs TraceFileSize
                | -systfn Number-Of-TraceFiles
                | -pchk on [ -intvl Interval-Time ]
                | -pchk off
                | -afb  on [ -intvl Interval-Time ]
                | -afb  off
                | -iem  on
                        [ -intvl Error-Monitor-Interval ]
                        [ -iemnum Number-Of-Times ]
                | -iem  off
                | -lic
                | -rmlu on [ -force ]
                | -rmlu off
                }
                [-s]
  Valid value
    ElogLevel               { 0 | 1 | 2 | 3 | 4 } (Default Value 3)
    ElogFileSize            { 100 - 2000000 }(KB) (Default Value 9900)
    Number-Of-ElogFiles     { 2 - 16 }(Files)     (Default Value 2)
    TraceLevel              { 0 | 1 | 2 | 3 | 4 } (Default Value 0)
    TraceFileSize           { 100 - 16000 }(KB)   (Default Value 1000)
    Number-Of-TraceFiles    { 2 - 64 }(Files)     (Default Value 4)
    Interval-Time           { 1 - 1440 }(Minute)  (Default Value 30)
      (pchk)
    Interval-Time           { 1 - 1440 }(Minute)  (Default Value 1)
      (afb)
    Error-Monitor-Interval  { 1 - 1440 }(Minute)  (Default Value 30)
    Number-Of-Times         { 1 - 99 }(Times)     (Default Value 3)
KAPL01001-I The HDLM command completed normally. Operation name = set, completion time
= yyyy/mm/dd hh:mm:ss
>
```

7.7 The View Operation

The `dlnkmgr` command's `view` operation displays HDLM program information, HDLM management-target device information, path information, and LU information. If the I/O load on the dynamic disk is heavy, it might take a long time to execute the `view` operation.

7.7.1 Format

To display program information:

```
dlnkmgr view -sys
    [-sfunc|-msrv|-adrv|-pdrv|-lic]
    [-t]
```

To display HDLM management-target device information:

```
dlnkmgr view -stinfo [-t]
```

To display path information:

```
dlnkmgr view -path
    [-hdev host-device-name]
    [-stname]
    [-iem]
    [-srt {pn|lu|cp}]
    [-exlu]
    [-t]
```

To display path information (by selecting a display item):

```
dlnkmgr view -path -item
    [pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu] [hd] [iep]
    [-hdev host-device-name]
    [-stname]
    [-srt {pn|lu|cp}]
    [-exlu]
    [-t]
```

To display a summary of path information:

```
dlnkmgr view -path -c
    [-stname]
    [-srt {lu|cp}]
    [-t]
```

To display LU information:

```
dlnkmgr view -lu
    [-hdev host-device-name|-pathid AutoPATH_ID]
    [-exlu]
    [-t]
```

To display LU information (by adding items to be displayed):

```
dlnkmgr view -lu -item
    [ [slpr] [pn] [cp] [clpr] [type] [ic] [ie] [dnu] [iep]|all ]
    [-hdev host-device-name|-pathid AutoPATH_ID]
    [-exlu]
    [-t]
```

To display a summary of LU information :

```
dlnkmgr view -lu -c
    [-exlu]
    [-t]
```

To display a summary of LU information (by adding items to be displayed):

```
dlnkmgr view -lu -c -item
    [slpr]
    [-exlu]
    [-t]
```

To display the format of the view operation:

```
dlnkmgr view -help
```

7.7.2 Parameters

This section describes the parameters for the view operation.

7.7.2.1 Parameters Used for Displaying Program Information

To displays the HDLM program information, use `-sys [-sfunc|-msrv|-adrv|-pdrv|-lic]`. Use one of the subsequent parameters (following `-sys`) to specify the program information that you want to display. If you do not specify a subsequent parameter, the command displays all program information.

Table 7.8 describes the specifiable parameters, displayed information, displayed items, and a corresponding description.

Note: The `-t` parameter does not display the title for each information item.

Table 7.8 Displayed Program Information

Parameter and Program Information	Item	Description
`-sfunc` Information about the HDLM function settings	`HDLM Version`	HDLM version number
	`Service Pack Version`	HDLM SP version number. This item is blank if a SP is not installed.
	`Load Balance`	Setting for load balancing ■ Setting status `on`: Enabled `off`: Disabled ■ Algorithm When the setting status of load balancing is `on`, the type of algorithm used for load balancing is displayed after the `on`. `rr`: Round robin `extended rr`: Extended round robin
	`Support Cluster`	Setting for cluster support*and the type of the cluster server ■ `on MSCS`: when MSCS is used for the cluster server ■ `off`: when no cluster is used or a cluster other than MSCS is used
	`Elog Level`	Error logging level ■ `0`: Collects no error information ■ `1`: Collects error information at the Error level or higher ■ `2`: Collects error information at the Warning level or higher ■ `3`: Collects error information at the Information level or higher ■ `4`: Collects error information at the Information or higher level (including maintenance information)
	`Elog File Size (KB)`	Size of the error log file in kilobytes
	`Number Of Elog Files`	Number of error log files

Parameter and Program Information	Item	Description
	Trace Level	Trace output level ■ 0: Does not output any trace ■ 1: Only outputs error information ■ 2: Outputs a summary of program operation ■ 3: Outputs details of program operation ■ 4: Outputs all information
	Trace File Size(KB)	Trace file size in kilobytes
	Number Of Trace Files	Number of trace files
-sfunc Information about the HDLM function settings	Path Health Checking	■ Setting for path health checking on: Enabled off: Disabled ■ Checking interval When the setting of the path health checking is on, the checking interval of path health checking is displayed within the parentheses, ( ), after on. The time is in minutes.
	Auto Failback	■ Setting for automatic failback on: Enabled off: Disabled ■ Checking interval When the setting of the automatic failback is on, the checking interval of automatic failback is displayed within the parentheses, ( ), after on. The time is in minutes.
	Remove LU	Setting for Remove LU ■ on: Enabled ■ off: Disabled
	Intermittent Error Monitor	■ Setting for intermittent error monitoring on: Enabled off: Disabled When automatic failback is off, intermittent error monitoring is disabled although Intermittent Error Monitor shows on. When automatic failback becomes on, intermittent error monitoring becomes enabled. ■ Intermittent error monitoring interval and number of times that the error is to occur. When intermittent error monitoring is set to on, the specified intermittent error monitoring interval and number of times that the error is to occur are displayed in parentheses, (), following on. The format is *number-of-times-error-is-to-occur/monitoring-interval*. The time is in minutes.
-msrv Information about the HDLM manager	HDLM Manager	Status of the HDLM manager ■ Alive: Normal ■ Dead: Stopped
	Ver	Version number of the HDLM manager

Parameter and Program Information	Item	Description
	WakeupTime	Startup time of the HDLM manager
-adrv Information about the HDLM alert driver	HDLM Alert Driver	Status of the HDLM alert driver ■ Alive: Normal ■ Dead: Stopped
	Ver	Version number of the HDLM alert driver
	WakeupTime	Startup time of the HDLM alert driver
	ElogMem Size	Size of error log memory for the HDLM alert driver in kilobytes
-pdrv Information about the HDLM driver	HDLM Driver	Status of the HDLM driver ■ Alive: Normal ■ Dead: Stopped
	Ver	Version number of the HDLM driver
	WakeupTime	Startup time of the HDLM driver
-lic Information about the HDLM license	License Type	License type ■ Permanent: permanent license ■ Temporary: temporary license ■ Emergency: emergency license
	Expiration	License expiration When using a permanent license: - When using a temporary license or emergency license: The license expiration period is displayed in the format: *yyyy/mm/dd* (*n* days after). When the view -sys -lic operation is executed, (*n*days after) appears if there are *n* days left until the license period expires. When there are 100 days left until the license period (2006/08/21) expires 2006/08/21(100days after)
*When the HDLM manager starts, HDLM cluster servers are automatically recognized.		

The following example shows how to display information about the HDLM function settings:

```
>dlnkmgr view -sys -sfunc
HDLM Version                  : xx-xx
Service Pack Version          :
Load Balance                  : on(rr)
Support Cluster               : off
Elog Level                    : 3
Elog File Size(KB)            : 9900
Number Of Elog Files          : 2
Trace Level                   : 0
Trace File Size(KB)           : 1000
Number Of Trace Files         : 4
Path Health Checking          : on(30)
Auto Failback                 : off
Remove LU                     : on
Intermittent Error Monitor    : off
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

The following example shows how to display information about the HDLM manager:

```
>dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Alive        xx-xx    yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

The following example shows how to display information about the HDLM alert driver:

```
>dlnkmgr view -sys -adrv
HDLM Alert Driver Ver     WakeupTime          ElogMem Size
Alive             xx-xx   yyyy/mm/dd hh:mm:ss 128
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

The following example shows how to display information about the HDLM driver:

```
>dlnkmgr view -sys -pdrv
HDLM Driver Ver       WakeupTime
Alive       xx-xx     yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

The following example shows how to display information about the HDLM license:

```
>dlnkmgr view -sys -lic
License Type Expiration
Permanent    -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
>
```

7.7.2.2 Parameters Used for Displaying HDLM Management-Target Device Information

Use the `-stinfo` parameter to display information about a HDLM management-target device (except the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V) that was set when HDLM was installed.

Table 7.9 describes the displayed items.

Table 7.9 HDLM Management-Target Device Information

Item	Description
`HDLM management-target device`	Name of the HDLM management-target device (except the Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V)
`Setting Status`	Setting status of the HDLM management-target device (except the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V). `on`: enabled `off`: disabled The HDLM management-target device (except the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V) can be set when the operating system is one of the following. Otherwise, this item always displays `off`. ▪ Windows Server 2003 (IA32) SP1 or later ▪ Windows Server 2003 (IPF) SP1 or later

The `-t` parameter does not display the title for each information item.

Example:

```
>dlnkmgr view -stinfo
EMC Symmetrix DMX Series, CLARiiON CX Series    : on
HP StorageWorks EVA Series                      : on
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
>
```

7.7.2.3 Parameters Used for Displaying Path Information

When displaying path information, if the -item parameter or the -c parameter is specified at the same time as the -path parameter, you can select the items to display and display a summary of path information. This section describes each parameter, path information and displayed items.

Parameters for Displaying Path Information

When you specify the -path parameter and do not specify either the -c or -item parameter, the -path command displays information about the paths without abbreviating or selecting items. In the subsequent sub-parameters (following -path), you can filter the paths to be listed (-hdev) and sort the list (-srt). When you omit both parameters, the command displays information for all the paths in order of ascending AutoPATH_IDs. For details on what is displayed in each item, see Table 7.11.

*AutoPATH_ID*s displayed by the -path parameter depend on the sequence in which HDLM detects the paths when a host is started. Because of this, make sure that you use the path name (PathName) to identify a path. The subsequent sub-parameters (following -path) are:

- -hdev *host-device-name*: Filters the information only for the paths accessing the specified host device. Specify a drive letter to indicate the desired host device. You cannot specify the host device unless a drive letter has been assigned. The *host-device-name* string is case-sensitive. If the command ended by displaying the KAPL01064-W or KAPL01013-E messages, perform the action recommended in the message.
- -stname: Use this parameter for the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V to display the model ID of the storage system in the product ID element of the DskName field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead. For more information pertaining to the storage system and corresponding product ID, see Table 7.13.
- -iem: Use this parameter to add IEP to path information and display information about intermittent errors.
- -srt {pn|lu|cp}: Use this parameter to sort the list of path information in ascending order, according to the specified sorting keys. The sorting keys are as follows: the first sorting key is the name of the storage system (DskName), the second sorting key is the value specified by the -srt parameter, and the third sorting key is AutoPATH_ID.

  The parameter values available to specify the second sorting key are:

  - pn: Path name
  - lu: LU number of the storage system
  - cp: Port number of the channel adapter

  When the -srt parameter is omitted, the path information is listed in order of ascending AutoPATH_IDs.

- `-exlu`: When an HDLM management-target device contains the EMC DMX series, EMC CX series, or HP EVA series. If this parameter is specified, the entire 32 digits of the `iLU` are displayed without truncating it to 13 digits. If this parameter is not specified, the `iLU` of the EMC DMX series, EMC CX series, and HP EVA series is displayed as 16 digits with the 14th to 16th digits displayed as periods (. . .). When an HDLM management-target device is configured of only the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V. 16 digits are displayed for the `iLU` even if this parameter is specified.
- The `-t` parameter does not display the title for each information item.

  For example, when the `-exlu` parameter is not specified:

```
>dlnkmgr view -path
Paths:000016 OnlinePaths:000016
PathStatus   IO-Count    IO-Errors
Online       1199        0

PathID PathName                          DskName                                    iLU
ChaPort Status     Type IO-Count   IO-Errors  DNum HDevName
000000 0002.0000.0000000000000000.000B EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -           131          0    0 L
000001 0002.0000.0000000000000000.000C EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -           132          0    0 M
000002 0002.0000.0000000000000000.000D EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -           131          0    0 N
000003 0002.0000.0000000000000000.000E EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -           133          0    0 O
000004 0002.0000.0000000000000001.0000 DGC     .RAID 10         .-               6006016099C50...
-       Online     -           203          0    0 F
000005 0002.0000.0000000000000001.0001 DGC     .RAID 5          .-               6006016099C50...
-       Online     -           174          0    0 G
000006 0002.0000.0000000000000002.0000 HITACHI .DF600F          .0329            0000
0A      Online     Own         138          0    0 P
000007 0002.0000.0000000000000002.0001 HITACHI .DF600F          .0329            0001
0A      Online     Non           0          0    0 Q
000008 0003.0000.0000000000000000.0000 DGC     .RAID 10         .-               6006016099C50...
-       Online     -             0          0    0 F
000009 0003.0000.0000000000000000.0001 DGC     .RAID 5          .-               6006016099C50...
-       Online     -             0          0    0 G
000010 0003.0000.0000000000000001.0000 EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -             4          0    0 L
000011 0003.0000.0000000000000001.0001 EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -             5          0    0 M
000012 0003.0000.0000000000000001.0002 EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -             4          0    0 N
000013 0003.0000.0000000000000001.0003 EMC     .SYMMETRIX       .-               6006048000018...
-       Online     -             6          0    0 O
000014 0003.0000.0000000000000002.0000 HITACHI .DF600F          .0329            0000
1A      Online     Non           0          0    0 P
000015 0003.0000.0000000000000002.0001 HITACHI .DF600F          .0329            0001
1A      Online     Own         138          0    0 Q
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
>
```

When the -exlu parameter is specified:

```
>dlnkmgr view -path -exlu
Paths:000016 OnlinePaths:000016
PathStatus   IO-Count    IO-Errors
Online       1199        0

PathID PathName                       DskName
iLU                                ChaPort Status     Type IO-Count   IO-Errors  DNum HDevName
000000 0002.0000.0000000000000000.000B EMC     .SYMMETRIX       .-
6006048000018781000153594D423031 -       Online     -           131          0    0 L
000001 0002.0000.0000000000000000.000C EMC     .SYMMETRIX       .-
6006048000018781000153594D423032 -       Online     -           132          0    0 M
000002 0002.0000.0000000000000000.000D EMC     .SYMMETRIX       .-
6006048000018781000153594D423033 -       Online     -           131          0    0 N
000003 0002.0000.0000000000000000.000E EMC     .SYMMETRIX       .-
6006048000018781000153594D423034 -       Online     -           133          0    0 O
000004 0002.0000.0000000000000001.0000 DGC     .RAID 10         .-
6006016099C50E0028CB54C558CDD911 -       Online     -           203          0    0 F
000005 0002.0000.0000000000000001.0001 DGC     .RAID 5          .-
6006016099C50E008C70FDB358CDD911 -       Online     -           174          0    0 G
000006 0002.0000.0000000000000002.0000 HITACHI .DF600F          .0329
0000                               0A      Online     Own         138          0    0 P
000007 0002.0000.0000000000000002.0001 HITACHI .DF600F          .0329
0001                               0A      Online     Non           0          0    0 Q
000008 0003.0000.0000000000000000.0000 DGC     .RAID 10         .-
6006016099C50E0028CB54C558CDD911 -       Online     -             0          0    0 F
000009 0003.0000.0000000000000000.0001 DGC     .RAID 5          .-
6006016099C50E008C70FDB358CDD911 -       Online     -             0          0    0 G
000010 0003.0000.0000000000000001.0000 EMC     .SYMMETRIX       .-
6006048000018781000153594D423031 -       Online     -             4          0    0 L
000011 0003.0000.0000000000000001.0001 EMC     .SYMMETRIX       .-
6006048000018781000153594D423032 -       Online     -             5          0    0 M
000012 0003.0000.0000000000000001.0002 EMC     .SYMMETRIX       .-
6006048000018781000153594D423033 -       Online     -             4          0    0 N
000013 0003.0000.0000000000000001.0003 EMC     .SYMMETRIX       .-
6006048000018781000153594D423034 -       Online     -             6          0    0 O
000014 0003.0000.0000000000000002.0000 HITACHI .DF600F          .0329
0000                               1A      Online     Non           0          0    0 P
000015 0003.0000.0000000000000002.0001 HITACHI .DF600F          .0329
0001                               1A      Online     Own         138          0    0 Q
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
>
```

Parameters for Displaying Path Information by Selecting a Display Item

When you specify the -path parameter together with the -item parameter, the command only displays the items specified by the value of the -item parameter. If you specify no value for the -item parameter, only the PathID and the Status fields are displayed.

Table 7.10 shows the items that can be selected by using the -item parameter and the parameter values that can be specified after the -item parameter.

Table 7.10 Items Selected Using the -item Parameter and Parameters Specified After the -item Parameter

Selectable Items	Parameter Values Specified After the **-path -item** Parameter
PathID*	None
Status*	None
PathName	pn
DskName	dn
iLU	lu
ChaPort	cp
Type	type
IO-Count	ic
IO-Errors	ie
DNum	dnu
HDevName	hd
IEP	iep
Because both PathID and Status are always displayed, they do not require any parameters to be specified.	

In the subsequent sub-parameters (following -path -item), you can filter the paths to be listed (-hdev) and sort the list (-srt). When you omit both parameters, the command displays information for all the paths in order of increasing AutoPATH_IDs.

The subsequent sub-parameters (following -path -item) are:

- -hdev *host-device-name*: Filters the information only for the paths accessing the specified host device. Specify a drive letter to indicate the desired host device. You cannot specify the host device unless a drive letter has been assigned. The *host-device-name* string is case-sensitive. When you specify this parameter, HDevName is displayed by default. Therefore, it is not necessary to specify hd for the -item parameter.

- -stname: Use this parameter for the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V to display the model ID of the storage system in the product ID element of the DskName field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead. When you use this parameter, DskName is displayed by default. Therefore, it is not necessary to specify dn for the -item parameter.

  For more information pertaining to the storage system and corresponding product ID, see Table 7.13.

- -srt {pn|lu|cp}: Use this parameter to sort the list of path information in ascending order, according to the specified sorting keys. The sorting keys are as follows: the first sorting key is the name of the storage system (DskName), the second sorting key is the value specified by the -srt parameter, and the third sorting key is AutoPATH_ID.

  The parameter values available to specify the second sorting key are:

  - pn: Path name
  - lu: LU number of the storage system
  - cp: Port number of the channel adapter

  When the -srt parameter is omitted, the path information is listed in order of ascending AutoPATH_IDs.

  When you use this parameter, the items used for the sorting keys (DskName, AutoPATH_ID, and the item specified by this parameter) are displayed by default. Therefore, it is not necessary to specify these items for the -item parameter.

- -exlu: When an HDLM management-target device contains the EMC DMX series, EMC CX series, or HP EVA series. If this parameter is specified, the entire 32 digits of the iLU are displayed without truncating it to 13 digits. If this parameter is not specified, the iLU of the EMC DMX series, EMC CX series, and HP EVA series is displayed as 16 digits with the 14th to 16th digits displayed as periods (. . .). When an HDLM management-target device is configured of only the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V. Even if this parameter is specified, 16 digits are displayed for the iLU .

- -t

  Does not display the title for each information item.

Example

In the following example, IO-Count is selected as the display item and the path information is sorted in ascending order of the LUs.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -item ic -srt lu -stname
Paths:000010  OnlinePaths:000010
PathStatus IO-Count   IO-Errors
Online     500        0

PathID DskName                                  iLU             Status
IO-Count
000003 HITACHI .9500V          .0123            0180            Online
400
000009 HITACHI .9500V          .0123            0180            Online
420
000004 HITACHI .9500V          .0123            0181            Online
410
000010 HITACHI .9500V          .0123            0181            Online
399
000005 HITACHI .9500V          .0123            0182            Online
405
000011 HITACHI .9500V          .0123            0182            Online
405
000000 HITACHI .USP_V          .0014050         000050          Online
1005
000006 HITACHI .USP_V          .0014050         000050          Online
897
000001 HITACHI .USP_V          .0014050         000051          Online
0
000007 HITACHI .USP_V          .0014050         000051          Online
0
000002 HITACHI .USP_V          .0014050         000052          Online
0
000008 HITACHI .USP_V          .0014050         000052          Online
0
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Parameters for Displaying a Summary of Path Information

If the -c parameter is specified at the same time as the -path parameter, only PathID, DskName, iLU, CP, Status, and Type are displayed from the path information managed by HDLM. The displayed contents are shortened so that each instance of path information is displayed on a single line. The items that are displayed are PathID, DskName, iLU, CP, Status, and Type. For details on what is displayed in each item, see Table 7.11.

When you use the -c parameter, the number of characters that can be displayed in the product ID element of the DskName field is limited to 10. Therefore, when there are 11 or more characters in the product ID, the 8th and following characters are abbreviated to ellipses (...). The subsequent sub-parameters (following -path -c) are:

- -stname: Use this parameter for the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V to display the model ID of the storage system in the product ID element of the DskName field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead.

  For more information on the storage system and corresponding product ID, see Table 7.13.

- -srt {lu|cp}: Use this parameter to sort the list of path information in ascending order, according to the specified sorting keys. The sorting keys are as follows: the first sorting key is the name of the storage system (DskName), the second sorting key is the value specified by the -srt parameter, and the third sorting key is AutoPATH_ID. The parameter values available to specify the second sorting key are:

  - lu: LU number of the storage system
  - cp: Port number of the channel adapter

  When the -srt parameter is omitted, the path information is listed in order of ascending AutoPATH_IDs.

- The -t parameter does not display the title for each information item.

The following example shows how to display a summary of the path information in the order of the iLUs:

```
>dlnkmgr view -path -c -srt lu
Paths:000016 OnlinePaths:000016
PathStatus   IO-Count    IO-Errors
Online       1199        0

PathID DskName                              iLU              CP Status     Type
000006 HITACHI .DF600F    .0329             0000             0A Online     Own
000014 HITACHI .DF600F    .0329             0000             1A Online     Non
000007 HITACHI .DF600F    .0329             0001             0A Online     Non
000015 HITACHI .DF600F    .0329             0001             1A Online     Own
000004 DGC     .RAID 10   .-                6006016099C50... -  Online     -
000008 DGC     .RAID 10   .-                6006016099C50... -  Online     -
000005 DGC     .RAID 5    .-                6006016099C50... -  Online     -
000009 DGC     .RAID 5    .-                6006016099C50... -  Online     -
000000 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
000010 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
000001 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
000011 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
000002 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
000012 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
000003 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
000013 EMC     .SYMMETRIX .-                6006048000018... -  Online     -
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
>
```

Displayed Path Information

Table 7.11 describes the displayed path information.

Table 7.11 Displayed Path Information

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
Paths		Total number of displayed paths, indicated by a decimal number.
OnlinePaths		Number of available paths in the displayed paths, indicated by a decimal number. When the value of Paths equals the value of OnlinePaths, all paths are online. If the value of OnlinePaths is less than that of Paths, some paths might have an error status, in which case you should check the status of individual paths and take appropriate action for any paths that have an error status.
PathStatus		Status of the displayed paths. The displayed status indicates the following: ■ Online: All paths are available. ■ Reduced: Some paths are not available. Reduced means that some paths might have an error status, in which case you should check the status of individual paths and take appropriate action for any paths that have an error status.
IO-Count		Total I/O count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is 2^{32} - 1 (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0.
IO-Errors		Total I/O error count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is 2^{32} - 1 (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0.
PathID		AutoPATH_ID indicated by a decimal number. AutoPATH_ID is assigned when the host is restarted.
PathName[3]	Not displayed	The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the physical path that will be affected by the change. Path name consists of the following four elements, separated by periods: ■ Host port number (hexadecimal number) ■ Bus number (hexadecimal number) ■ Target ID (hexadecimal number) ■ Host LU number (hexadecimal number) For details about each element of the path name and its representation in Windows, see Table 7.12.

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
DskName[3]	DskName	The storage system name, which identifies the storage system that is accessed by a path. A storage system name consists of the following three elements, separated by periods: ■ Vendor ID: The name of the storage system vendor (for example, HITACHI). ■ Product ID: Indicates the storage system product ID, emulation type, or model ID (for example, DF600F). For more details, see Table 7.13. ■ Serial number: For the Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V, the serial number of the storage system (for example, 0051) For the EMC DMX series, EMC CX series, and HP EVA series, a hyphen (-) is displayed. For the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V, you can identify an actual storage system by referencing the above information from the storage system management program.
iLU[3]	iLU	■ For the Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V: LU number of the storage subsystem. This number combined with the storage system name (shown in DskName) identifies the LU that is accessed by a path. For TagmaStore USP, Lightning 9900V Series, and Lightning 9900 Series, the first two characters of iLU are the CU (Control Unit) number, and the last two characters are the internal LU number within the CU. Indicated by a hexadecimal number. For the TagmaStore AMS/WMS series, Thunder 9500V Series, and Thunder 9200 Series, the entire value of iLU is the internal LU number within the storage system. You can identify an actual LU by referencing iLU from the storage system management program. Indicated by a decimal number. For Universal Storage Platform V, indicated by a hexadecimal number. The first two characters of iLU are the number of the logical DKC (Disk Controller), the middle two numbers are the CU (Control Unit) number, and the last two characters are the internal LU number within the CU. ■ For the EMC DMX series, EMC CX series, and HP EVA series: The ID that differs from the LU number in the storage system and that identifies the LU is indicated by a hexadecimal number. The value of iLU consists of 32 digits. The first 13 digits of iLU are displayed, and periods (...) are displayed for the 14th to 16th digits. When the -exlu parameter is specified, the entire value of iLU is displayed.
ChaPort[3]	CP	■ For Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V: The port number of the channel adapter, which identifies the CHA port that is mounted on the storage system. You can identify an actual CHA port by referencing this number from the storage system management program. For the Lightning 9900V Series, the port number of the channel adapter is the same as the number shown by the SVP. ■ For the EMC DMX series, EMC CX series, and HP EVA series: A hyphen (-) is displayed.

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
Status		Status of the path ■ Online: Online ■ Offline(C): Placed offline using the Path Management window of the HDLM GUI or by a command ■ Offline(E): Offline due to an error ■ Online(E): Failure has occurred (If none of the paths accessing one LU have an Online status, one of those paths is changed to the Online(E) status.) ■ Online(P): offline operation on an Online path is waiting to execute[4] ■ Offline(P): offline operation on an Offline(E) path is waiting to execute[#2] ■ Online(EP): offline operation on an Online(E) path is waiting to execute[4] Paths that are Offline(E) or Online(E) require corrective action. The appropriate action can be determined by referring to section 5.3.
Type[3]	Type	■ For Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V: Attribute of the path Own: Owner path Non: Non-owner path When connecting to TagmaStore USP, Lightning 9900V Series, Lightning 9900 Series, TagmaStore, or Universal Storage Platform V all paths are owner paths. ■ For the EMC DMX series, EMC CX series, and HP EVA series: A hyphen (-) is displayed.
IO-Count[3]	Not displayed	Total I/O count for the path, indicated by a decimal number. The maximum value that can be displayed is 2^{32} - 1 (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Count value to zero, execute the dlnkmgr command's clear operation. Executing the clear operation also resets the number of I/O errors (IO-Errors) to zero. For details about the clear operation, see section 7.2.
IO-Errors[3]	Not displayed	Total I/O error count for the path, indicated by a decimal number. The maximum value that can be displayed is 2^{32} - 1 (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Errors value to zero, execute the dlnkmgr command's clear operation. Executing the clear operation also clears the number of I/O operations (IO-Count) to zero. For details about the clear operation, see section 7.2.
DNum[3]	Not displayed	0 is displayed as Dev indicating the entire LU.
HDevName[3,5]	Not displayed	Host device name. A drive letter is displayed. If no drive letter has been assigned, a hyphen (-) is displayed. The drive letter is displayed in the HDevName field even if the value of the DNum field is 0. Note, however, that the displayed drive letter is the drive letter for one of the Devs included in the LU.

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
IEP	Not displayed	Information about the intermittent error. This item is displayed only when you specify –iem with the –path parameter. One of the following values is displayed for each path: ■ – indicates that intermittent error monitoring is disabled or the monitoring time for an intermittent error is out of range (the path status is Online(E) or Offline(E)). ■ A value of at least 0 indicates the number of errors that occurred during intermittent error monitoring (the path status is Online(E), Offline(E), or Online). ■ * indicates that an intermittent error occurred (automatic failback does not check the path) (the path status is Online, Online(E), or Offline(C)).
[1] No summary displayed indicates that the user specifies the –path parameter or –path –item parameter.		
[2] Summary displayed indicates that the user specifies the –path –c parameter.		
[3]The path information is displayed only when a value is specified for the –path –item parameter.		
[4]In a cluster configuration, an offline operation requested during reserve processing is put into the waiting-to-execute state, and does not execute until the reserve processing finishes.		
[5]The drive letter assigned to a dynamic disk volume is not displayed.		

Table 7.12 describes the elements of a path name.

Table 7.12 Elements of a Path Name

Element	Windows Representation
Host port number (hexadecimal) (***example:*** 0004, 0005)	SCSI port number
Bus number (***example:*** 0001)	SCSI bus number
Target ID (***example:*** 0000000000000000, 000000000000007A)	Target Id
Host LU number0001)	Logical Unit ID or LUN

The path name corresponds to the following information:

- Information shown in the Computer Management window.
- The information in the following registry:

  HKEY_LOCAL_MACHINE\HARDWARE\DEVICEMAP\Scsi

Note: When an FC connection is used, the target ID of a SCSI is determined based on the HBA configuration. For details on the target ID, see the relevant documentation, such as the HBA manual.

Table 7.13 shows the product ID displayed by the -path Operation View.

Table 7.13 Product ID Displayed in the -path Operation View

Model Names of Storage Systems	Product ID	
	Without `-stname` Parameter	**With `-stname` Parameter (displays the following for the model ID)**
EMC DMX series	Product identifier	
EMC CX series		
HP EVA series		
Thunder 9200	Product identifier#	9200
Thunder 9500V Series		9500V
TagmaStore AMS		AMS
TagmaStore WMS		WMS
Lightning 9900 Series	Emulation type*	9910/9960
Lightning 9900V Series		9970/9980
SVS		SVS
■ Hitachi TagmaStore Universal Storage Platform 100 ■ Hitachi TagmaStore Universal Storage Platform 600 ■ Hitachi TagmaStore Universal Storage Platform 1100 ■ TagmaStore NSC55		USP
Hitachi Universal Storage Platform V		USP_V
XP128		XP128
XP1024		XP1024
XP10000		XP10000
XP12000		XP12000
XP24000		XP24000
*When a summary is displayed by specifying the `-path -c` parameter and there are more than 11 characters in the summary string, characters after the 9th character are displayed as an ellipsis (. . .). For command devices, "**-CM**" is added to the end of the emulation type of the storage system (for example, DF600F-CM).		

7.7.2.4 Parameters Used for Displaying LU Information

When displaying LU information, If the `-item` parameter, `-c` parameter, or the `-c -item` parameter is specified at the same time as the `-lu` parameter, you can add and display items and display a summary of LU information. This section describes each parameter and the LU information and displayed items.

Parameters for Displaying LU Information

When neither the `-c` nor `-item` parameter is specified with the `-lu` parameter, the information about the LU recognized by HDLM is displayed. The sorting key is iLU and its configuration information is displayed for each LU.

Note that:

- In the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V, LU information is displayed for each storage subsystem.
- In the EMC DMX series and EMC CX series, LU information is displayed for each vendor ID.
- In the HP EVA series, LU information is displayed for each *vendor_ID_product_ID*.

By using the subsequent parameter (`-hdev` or `-pathid`), you can filter the LU information to be displayed. If you do not specify `-hdev` or `-pathid`, the information about all LUs recognized by HDLM is displayed. For details on the contents of each displayed item, see Table 7.15. The subsequent parameters are:

- `-hdev` *`host-device-name`*: Filters the information only for the paths accessing the specified host device. Specify a drive letter to indicate the desired host device. You cannot specify the host device unless a drive letter has been assigned. The *`host-device-name`* string is case-sensitive. If the command ended by displaying the KAPL01064-W or KAPL01013-E messages, follow the steps recommended in the message.
- `-pathid` *`AutoPATH_ID`*: Use this parameter to display only the information about the LU to which the path with the specified *AutoPATH_ID* is connected.
- `-exlu`: Use this parameter when an HDLM management-target device is the EMC DMX series, EMC CX series, or HP EVA series. If this parameter is specified when a device managed by HDLM is the EMC DMX series, EMC CX series, and HP EVA series, the entire 32 digits of the `iLU` are displayed without truncating it to 13 digits. If this parameter is not specified, the `iLU` of the EMC DMX series, EMC CX series, and HP EVA series is displayed as 16 digits with the 14th to 16th digits displayed as periods (. . .). When an HDLM management-target device is the Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, or Universal Storage Platform V. Less than 16 digits are always displayed for the `iLU` whether or not this parameter is specified.

- The `-t` parameter does not display the title for each information item.

  For example, when the `-exlu` parameter is not specified:

```
>dlnkmgr view -lu
Product      : 9500V
SerialNumber : 0329
LUs          : 2

iLU  HDevName PathID Status
0000 P        000006 Online
              000014 Online
0001 Q        000007 Online
              000015 Online

Product      : DGC
SerialNumber : -
LUs          : 2

iLU              HDevName PathID Status
6006016099C50... F        000004 Online
                          000008 Online
6006016099C50... G        000005 Online
                          000009 Online

Product      : EMC
SerialNumber : -
LUs          : 4

iLU              HDevName PathID Status
6006048000018... L        000000 Online
                          000010 Online
6006048000018... M        000001 Online
                          000011 Online
6006048000018... N        000002 Online
                          000012 Online
6006048000018... O        000003 Online
                          000013 Online
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
>
When the -exlu parameter is specified:

>dlnkmgr view -lu -exlu
Product      : 9500V
SerialNumber : 0329
LUs          : 2

iLU  HDevName PathID Status
0000 P        000006 Online
              000014 Online
0001 Q        000007 Online
              000015 Online

Product      : DGC
SerialNumber : -
LUs          : 2

iLU                              HDevName PathID Status
6006016099C50E0028CB54C558CDD911 F        000004 Online
                                          000008 Online
6006016099C50E008C70FDB358CDD911 G        000005 Online
                                          000009 Online

Product      : EMC
SerialNumber : -
LUs          : 4
```

```
iLU                                HDevName PathID Status
60060480000187810001535940423031 L        000000 Online
                                           000010 Online
60060480000187810001535940423032 M        000001 Online
                                           000011 Online
60060480000187810001535940423033 N        000002 Online
                                           000012 Online
60060480000187810001535940423034 O        000003 Online
                                           000013 Online
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
>
```

Parameters for Displaying LU Information by Adding Items to be Displayed

In the -lu -item parameter, the items specified with the -item option are added to the items to be displayed by the -lu option and displayed. If no value or all is specified for the -item parameter, all the items that can be added are displayed.

Table 7.14 shows the items that can be added by using the -item parameter and the parameters that can be specified after the -item parameter.

Table 7.14 Items Added Using -item Parameter and Parameters Specified After –item Parameter

Item Added	Subsequent Parameter
SLPR	slpr
PathName	pn
ChaPort	cp
CLPR	clpr
Type	type
IO-Count	ic
IO-Errors	ie
DNum	dnu
IEP	iep
All items are displayed	all

In the subsequent sub-parameters (-hdev or -pathid), you can filter the LU information to be displayed. When you omit both parameters, the command displays the information about all the LUs recognized by HDLM.

For details on the contents of each displayed item, see Table 7.15.

The subsequent sub-parameters are:

- -hdev *host-device-name*: Filters the information only for the paths accessing the specified host device. Specify a drive letter to indicate the desired host device. You cannot specify the host device unless a drive letter has been assigned. The *host-device-name* string is case-sensitive. If the command ended by displaying the KAPL01064-W or KAPL01013-E messages, follow the steps recommended in the message.
- -pathid *AutoPATH_ID*: Use this parameter to display only the information about the LU to which the path with the specified *AutoPATH_ID* is connected.

- `-exlu`: When an HDLM management-target device is the EMC DMX series, EMC CX series, or HP EVA series. If this parameter is specified when a device managed by HDLM is the EMC DMX series, EMC CX series, and HP EVA series, the entire 32 digits of the `iLU` are displayed without truncating it to 13 digits. If this parameter is not specified, the `iLU` of the EMC DMX series, EMC CX series, and HP EVA series is displayed as 16 digits with the 14th to 16th digits displayed as periods (. . .). When an HDLM management-target device is the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V. Fewer than 16 digits are always displayed for the `iLU` whether or not this parameter is specified.
- The `-t` parameter does not display the title for each information item.

  The following example shows how to add `SLPR`, `PathName`, `ChaPort`, `CLPR`, `Type IO-Count`, `IO-Errors`, `DNum`, and `IEP` to the displayed items for LU information.

```
>dlnkmgr view -lu -item
Product       : USP
SerialNumber  : 0014050
LUs           : 3

iLU  SLPR HDevName PathID PathName                        ChaPort CLPR Status Type IO-Count
IO-Errors  DNum IEP
0110    1 E        000000 0002.0000.0000000000000000.0000 0A         2 Online Own         4
        0     0 0
                   000003 0003.0000.0000000000000001.0000 0B         2 Online Own         4
        0     0 0
0111    1 F        000001 0002.0000.0000000000000000.0001 0A         2 Online Own         4
        0     0 0
                   000004 0003.0000.0000000000000001.0001 0B         2 Online Own         4
        0     0 0
0112    1 G        000002 0002.0000.0000000000000000.0002 0A         2 Online Own         4
        0     0 0
                   000005 0003.0000.0000000000000001.0002 0B         2 Online Own         4
        0     0 0
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
>
```

Parameters for Displaying a Summary of LU Information

In the `-lu -c` parameter, when the `-c` parameter is specified with the `-lu` parameter, a summary of LU configuration information is displayed on a line. The total number of paths recognized by HDLM and the number of online paths are displayed for each LU.

Note that:

- In the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V, LU information is displayed for each storage subsystem.
- In the EMC DMX series and EMC CX series, LU information is displayed for each vendor ID.
- In the HP EVA series, LU information is displayed for each *vendor_ID_product_ID*.

You cannot specify the `-c` parameter together with the `-hdev` or `-pathid` parameter.

For details on the contents of each display item, see Table 7.15.

In the `-exlu` parameter, when an HDLM management-target device contains the EMC DMX series, EMC CX series, or HP EVA series. If this parameter is specified, the entire 32 digits of the `iLU` are displayed without truncating it to 13 digits. If this parameter is not specified, the `iLU` of the EMC DMX series, EMC CX series, and HP EVA series is displayed as 16 digits with the 14th to 16th digits displayed as periods (`...`). When an HDLM management-target device is configured of only the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V, 16 digits are displayed for the `iLU` even if this parameter is specified.

The `-t` parameter does not display the title for each information item.

When the `-exlu` parameter is not specified:

```
dlnkmgr view -lu -c
Product  S/N  LUs iLU              HDevName Paths  OnlinePaths
9500V    0329   2 0000             P             2           2
                  0001             Q             2           2
DGC      -      2 6006016099C50... F             2           2
                  6006016099C50... G             2           2
EMC      -      4 6006048000018... L             2           2
                  6006048000018... M             2           2
                  6006048000018... N             2           2
                  6006048000018... O             2           2
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
>
```

When the `-exlu` parameter is specified:

```
>dlnkmgr view -lu -c -exlu
Product  S/N  LUs iLU                              HDevName Paths  OnlinePaths
9500V    0329   2 0000                             P             2           2
                  0001                             Q             2           2
DGC      -      2 6006016099C50E0028CB54C558CDD911 F             2           2
                  6006016099C50E008C70FDB358CDD911 G             2           2
EMC      -      4 60060480000187810001535940423031 L             2           2
                  60060480000187810001535940423032 M             2           2
                  60060480000187810001535940423033 N             2           2
                  60060480000187810001535940423034 O             2           2
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
>
```

Parameters for Displaying a Summary of LU Information by Adding Items to be Displayed

In the `-lu -c -item` parameter, the items specified with the `-item` option are added to the items to be displayed by the `-lu -c` option and displayed. If no value is specified for the `-item` parameter, all the items that can be added are displayed. See Table 7.15 for the contents of each displayed item.

The `SLPR` parameter can be added by using the `-item` parameter, and the `slpr` parameter can be specified after the `-item` parameter.

The subsequent sub-parameter is `-exlu`. When an HDLM management-target device contains the EMC DMX series, EMC CX series, or HP EVA series. If this parameter is specified, the entire 32 digits of the `iLU` are displayed without truncating it to 13 digits. If this parameter is not specified, the `iLU` of the EMC DMX series, EMC CX series, and HP EVA series is displayed as 16 digits with the 14th to 16th digits displayed as periods (. . .). When an HDLM management-target device is configured of only the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, or Universal Storage Platform V,16 digits are displayed for the `iLU` even if this parameter is specified.

The `-t` parameter does not display the title for each information item.

The following example describes how to add and display a summary of SLPR.

```
>dlnkmgr view -lu -c -item
Product S/N     LUs iLU  SLPR HDevName Paths  OnlinePaths
9500V   3679      3 0150    - H             2           2
                    0151    - I             2           2
                    0152    - J             2           2
USP     0014050   3 0110    1 E             2           2
                    0111    1 F             2           2
                    0112    1 G             2           2
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
>
```

Displayed LU Information

Table 7.15 describes the displayed LU information. The following explains the table headings.

Table 7.15 Displayed LU Information

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
Product		▪ For the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V: Model name of the storage system ▪ For the EMC DMX series and EMC CX series: Vendor ID ▪ For the HP EVA series: *Vendor ID_Product ID*
Serial Number	S/N	▪ For the Thunder 9200/9500V Series, Lightning 9900/9900V Series, TagmaStore, and Universal Storage Platform V: Serial number of the storage system ▪ For the EMC DMX series, EMC CX series, and HP EVA series: A hyphen (-) is displayed.
LUs		Total number of LUs managed by HDLM among the LUs in the storage system
iLU		▪ For the Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V: LU number in the storage system This number combined with the storage system name (shown in DskName) identifies the LU that is accessed by a path. For the TagmaStore USP, Lightning 9900V Series, and Lightning 9900 Series, the first two characters of iLU are the CU (Control Unit) number, and the last two characters are the internal LU number within the CU. Indicated by a hexadecimal number. For the TagmaStore AMS/WMS series, Thunder 9500V Series, and Thunder 9200 Series, the entire value of iLU is the internal LU number within the storage system. You can identify an actual LU by referencing iLU from the storage system management program. Indicated by a decimal number. For Universal Storage Platform V, indicated by a hexadecimal number. The first two characters of iLU are the number of the logical DKC (Disk Controller), the middle two numbers are the CU(Control Unit) number, and the last two characters are the internal LU number within the CU. For the EMC DMX series, EMC CX series, and HP EVA series: The ID that differs from the LU number in the storage system and that identifies the LU is indicated by a hexadecimal number. The value of iLU consists of 32 digits. The first 13 digits of iLU are displayed, and periods (. . .) are displayed for the 14th to 16th digits.
SLPR[3]	SLPR[4]	The number of the SLPR to which the LU belongs, indicated by a decimal number from 0 to 31. A hyphen (–) is displayed if the storage logical partition functionality for the storage system for the target LU is not supported.
HDevName[3,5]	–	Host device name. A drive letter is displayed. If no drive letter has been assigned, a hyphen (-) is displayed. The drive letter is displayed in the HDevName field even if the value of the DNum field is 0. Note, however, that the displayed drive letter is the drive letter for one of the Devs included in the LU.

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
PathID	Not displayed	AutoPATH_ID indicated by a decimal number. AutoPATH_ID is assigned when the host is restarted.
PathName[3]	Not displayed	The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the path that will be affected by the change. Path name consists of the following four elements, separated by periods: ▪ Host port number (hexadecimal number) ▪ Bus number (hexadecimal number) ▪ Target ID (hexadecimal number) ▪ Host LU number (hexadecimal number) For details about each element of the path name and its representation in Windows, see Table 7.12.
ChaPort[3]	Not displayed	▪ For the Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V: Port number of the channel adapter, which identifies the CHA port that is mounted on the storage system. You can identify an actual CHA port by referencing this number from the storage system management program. For the Lightning 9900V Series, the port number of the channel adapter is the same as the number shown by the SVP. ▪ For the EMC DMX series, EMC CX series, and HP EVA series: A hyphen (-) is displayed.
CLPR[3]	Not displayed	The number of the CLPR to which the CHA port belongs, indicated by a decimal number from 0 to 31. Note that a hyphen (-) is displayed if the following items are subject to display: ▪ CHA ports in the storage system that do not support cache logical partition functionality ▪ Paths connected to the Snapshot Image of the Copy-on-write Snapshot of the TagmaStore AMS/WMS series
Status	Not displayed	Status of the path ▪ Online: Online ▪ Offline(C): Placed offline by using the Path Management window of the HDLM GUI or by a command ▪ Offline(E): Offline due to an error ▪ Online(E): Failure has occurred (If none of the paths accessing one LU have an Online status, one of those paths is changed to the Online(E) status.) ▪ Online(P): offline operation on an Online path is waiting to execute[6] ▪ Offline(P): offline operation on an Offline(E) path is waiting to execute[6] ▪ Online(EP): offline operation on an Online(E) path is waiting to execute[6] Paths that are Offline(E) or Online(E) require corrective action. The appropriate action can be determined by referring to section 5.3.

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
Type[3]	Not displayed	▪ For the Thunder 9200/9500V Series, Lightning 9900/9900V Series TagmaStore, and Universal Storage Platform V: Attribute of the path Own: Owner path Non: Non-owner path When connected to the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V, all paths are owner paths. ▪ For the EMC DMX series, EMC CX series, and HP EVA series: A hyphen (-) is displayed.
IO-Count[3]	Not displayed	Total I/O count for the path, indicated by a decimal number. The maximum value that can be displayed is 2^{32} - 1 (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Count value to zero, execute the dlnkmgr command's clear operation. Executing the clear operation also resets the number of I/O errors (IO-Errors) to zero. For details about the clear operation, see section 7.2.
IO-Errors[3]	Not displayed	Total I/O error count for the path, indicated by a decimal number. The maximum value that can be displayed is 2^{32} - 1 (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Errors value to zero, execute the dlnkmgr command's clear operation. Executing the clear operation also clears the number of I/O operations (IO-Count) to zero. For details about the clear operation, see section 7.2.
DNum[3]	Not displayed	0 is displayed as Dev indicating the entire LU.
IEP[3]	Not displayed	The displayed paths are assumed to be in an intermittent error status and checked whether those paths are to be operated for automatic failback. One of the following values is displayed for each path: ▪ An – indicates that intermittent error monitoring is disabled or the monitoring time for an intermittent error is out of range. ▪ A value of at least 0: Indicates the number of errors that occurred during intermittent error monitoring. ▪ An *: Indicates that an intermittent error occurred (automatic failback does not check the path).
Not displayed	Paths	Total number of the paths recognized by HDLM for the LU to be displayed, indicated by a decimal number
Not displayed	OnlinePaths	Number of available paths among the paths recognized by HDLM for the LU to be displayed, indicated by a decimal number. When the value of Paths is equal to the value of OnlinePaths, all paths are online. If the value of OnlinePaths is less than that of Paths, some paths may have an error status, in which case you should check the status of individual paths and take appropriate action for any paths that have an error status.
[1]No summary displayed: The user specifies the -lu parameter or -lu -item parameter.		
[2]Summary displayed: The user specifies the -lu -c parameter or -lu -c -item parameter.		

Displayed Item		Description
No Summary Displayed[1]	**Summary Displayed[2]**	
[3]This information is displayed when one of the following conditions exist: ▪ The user selected the item to be displayed by using the `-lu -item` parameter. ▪ `all` was specified. ▪ No value was specified for the parameter.		
[4]This information is displayed when one of the following conditions exist: ▪ The user selected the item to be displayed by using the `-lu -c -item` parameter. ▪ No value was specified for the parameter.		
[5]The drive letter assigned to a dynamic disk volume is not displayed.		
[6]In a cluster configuration, an `offline` operation requested during reserve processing is put into the waiting-to-execute state, and does not execute until the reserve processing finishes.		

7.7.2.5 Parameters Used for Displaying the Format of the View Operation

Use the `-help` parameter to display the `view` operation format.

Example:

```
>dlnkmgr view -help
view:
  Format
    dlnkmgr view -sys [ -sfunc | -msrv | -adrv | -pdrv | -lic ] [-t]
    dlnkmgr view -stinfo [-t]
    dlnkmgr view -path [ -hdev HostDeviceName ] [-stname] [-iem]
                                          [-srt {pn | lu | cp}] [-exlu] [-t]
    dlnkmgr view -path
                 -item [pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu] [hd] [iep]
                 [ -hdev HostDeviceName ] [-stname]
                                          [-srt {pn | lu | cp}] [-exlu] [-t]
    dlnkmgr view -path -c [-stname] [-srt {lu | cp}] [-t]
    dlnkmgr view -lu [ -hdev HostDeviceName | -pathid AutoPATH_ID ]
                                                          [-exlu] [-t]
    dlnkmgr view -lu
                 -item [ [slpr] [pn] [cp] [clpr] [type]
                                                [ic] [ie] [dnu] [iep] | all ]
                           [ -hdev HostDeviceName | -pathid AutoPATH_ID ]
                                                          [-exlu] [-t]
    dlnkmgr view -lu -c [-exlu] [-t]
    dlnkmgr view -lu -c -item [slpr] [-exlu] [-t]
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
>
```

Chapter 8 Utility Reference

This chapter explains the utilities used by HDLM. Utilities are discussed in the following sections:

- Overview of utilities (see section 8.1)
- The DLMgetras utility (see section 8.2)
- The dlmpr utility (see section 8.3)
- The dlmprsvkey utility (see section 8.4)
- The dlmchkpath utility (see section 8.5)

8.1 Overview of the Utilities

HDLM provides the following utilities:

- The `DLMgetras` utility for collecting HDLM error information.

  When an error occurs, this utility collects the files that contain information to be submitted to your HDLM vendor or maintenance company. For details about the `DLMgetras` utility, see section 8.2.

- The utility for clearing HDLM persistent reservation (`dlmpr`).

  This utility cancels remaining persistent reservations after an un-installation. For details about the `dlmpr` utility, see section 8.3.

- The utility for registering HDLM persistent reservation key (`dlmprsvkey`).

  This utility registers and displays PRSV key. For details about the `dlmprsvkey` utility, see section 8.4.

- The utility for checking the HDLM path (`dlmchkpath`).

  This utility checks whether the system is in a single-path configuration. For details about the `dlmchkpath` utility, see section 8.5.

Note: The utilities must be executed by a user belonging to the administrator group.

8.2 The DLMgetras Utility for Collecting HDLM Error Information

This utility collects information that is needed to analyze HDLM errors that have occurred: information such as error logs, integrated trace files, trace files, definition files, and operating system information. The collected information is archived in a file and saved to the directory that you specified.

When the system is restarted, a part of the information that was collected by the `DLMgetras` utility will be cleared. If an error occurs, immediately execute this utility.

8.2.1 Format

8.2.1.1 When Executing the DLMgetras Utility from the Command Prompt

`DLMgetras {`*`folder-to-which-collected-information-is-output`* `[-eventlogsize` *`log-size`* `| -eventlogtime` *`yyyy/mm/dd`*`] |-h}`

You can also use lower-case characters (`dlmgetras`) as follows:

`dlmgetras {`*`folder-to-which-collected-information-is-output`* `[-eventlogsize` *`log-size`* `| -eventlogtime` *`yyyy/mm/dd`*`] |-h}`

8.2.1.2 When Executing the DLMgetras Utility from the Windows Start Menu

From the Windows **Start** menu, choose **Programs**, **Dynamic Link Manager**, and then **DLMgetras** to execute the utility for collecting HDLM error information (`DLMgetras`).

8.2.2 Parameters

You can specify parameters only when you have executed the `DLMgetras` utility from the command prompt.

- *`folder-to-which-collected-information-is-output`*

  Specify the output folder for the information that is to be collected by the `DLMgetras` utility for collecting HDLM error information. The output-destination directories shown in Table 8.1 are created in the specified folder, and the information is collected in the output-destination folders.

- `-eventlogsize` *`log-size`*

  The utility obtains logs from each application, system, and security event log. The logs are obtained, starting from the most recent log, until the log size reaches *`log-size`*. Specify the log size in MB. The specifiable value ranges from 1 to 4096 in units of 1 MB. You cannot use this parameter together with the `-eventlogtime` *`yyyy/mm/dd`* parameter.

- `-eventlogtime` *`yyyy/mm/dd`*

The utility obtains logs from each application, system, and security event log. The logs obtained are those output after 00:00 on the date *yyyy/mm/dd*. Specify the date in the *YYYY/MM/DD* format. You cannot use this parameter together with the `-eventlogsize` *log-size* parameter.

- `-h`

  Displays the format of the `DLMgetras` utility.

8.2.3 List of Collected Error Information

Table 8.1 lists the types of error information collected by the `DLMgetras` utility for collecting error information in the folder to which error information is output.

Table 8.1 List of Error Information Collected by DLMgetras Utility

Collected Files[1] Folder	Files	Explanation
Just under the folder to which collected information is output	`getras`*n*`.log`	The log file generated when `DLMgetras` is executed.
folder-to-which-collected-information-is-output`\`*HDLM-installation-destination-drive-name*`_\Program Files\HITACHI\DynamicLinkManager`[2]	`hdlmservicepack`	HDLM SP version number
	`hdlmversion`	HDLM version number
folder-to-which-collected-information-is-output`\`*HDLM-installation-destination-drive-name*`_\Program Files\HITACHI\DynamicLinkManager\log`[2]	`dlmmgr`*n*`.log`	HDLM Manager log (including the driver log)
	`dlmprsvkey.log`	PRSV key log
	`hcmdslicense2.log`	Log when updating the license
	`hdlmtr`*n*`.log`	Trace file
	`hs_err_pid`*nnnn*`.log`	Java execution log (*nnnn* indicates a process ID)

folder-to-which-collected-information-is-output`\`*folder-to-which-Windows-is-introduced* (`%SystemRoot%`)	`setupact.log`
	`setupapi.log`
	`setuperr.log`
		Windows log

folder-to-which-collected-information-is-output`\`*HDLM-installation-destination-drive-name*`_\Program Files\HITACHI\DynamicLinkManager\log\mmap`[2]	`hdlmtr.mm`	Trace management file
folder-to-which-collected-information-is-output`\`*HDLM-installation-destination-drive-name*`_\Program Files\HITACHI\DynamicLinkManager\log`[2]	`dlmgui1.log` `dlmgui2.log`	HDLM GUI log
	`dlmgui_launcher1.log` `dlmgui_launcher2.log`	HDLM GUI log
	`dlmwebagent[1-`*N*`].log`[3]	HDLM remote access interface log
	`installhdlm.log`	Unattended installation log
folder-to-which-collected-information-is-output`\`*HDLM-installation-destination-drive-name*`_\Program Files_\HITACHI\DynamicLinkManager\config`[2]	`dlmgui_version`	HDLM GUI version and build numbers
	`dlmmgr.xml`	HDLM configuration file
	`dlmwebagent.properties`	Configuration file for HDLM remote access interface
folder-to-which-collected-information-is-output`\`*Windows-installation-destination-drive-name*`\Windows\Cluster`	`cluster.log`	MSCS log

Collected Files[1] Folder	Files	Explanation
*folder-to-which-collected-information-is-output**VxVM-installation-destination-drive-name*_Program Files\Veritas\Volume Manager M.N\logs[4]	All files under logs	VxVM log
*folder-to-which-collected-information-is-output**VCS-installation-destination-drive-name*_Program Files\Veritas\Cluster Server\log	All files under log	VCS log
Integrated-trace-file-output-folder-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility (Default: *folder-to-which-collected-information-is-output**installation-destination-drive-name*_\Program Files[5]\HITACHI\HNTRLib2\spool)	hntr*n*.log[6]	Integrated trace file (HNTRLib2)
Integrated-trace-file-output-folder-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility (Default: *folder-to-which-collected-information-is-output**installation-destination-drive-name*_*Program Files*\HITACHI\HNTRLib\spool*)	hntr[1-16].log	Integrated trace file (HNTRLib)
folder-to-which-collected-information-is-output\getrasinfo	application-list.txt	List of uninstallation information
	cluster-sys.txt	MSCS information
	dirHdlmRoot.txt	All the folders and the list of files in the HDLM installation destination folder
	dirSystemRoot.txt	All the folders and the list of files in the Windows installation destination folder
	dlm_iscsims.txt[7]	Contents of the iscsicli.exe
	dlm-reg.txt	Contents of the HDLM registry
	dlmmemorytrace.txt	HDLM memory trace information
	dlmmgr-lic.txt	Result of the dlnkmgr view –sys –lic command
	dlmmgr-lu.txt	Result of the dlnkmgr view -lu -item pn cp type ic ie dnu slpr clpr -exlu command
	dlmmgr-lu-all.txt	Result of the dlnkmgr view -lu -item all -exlu command

Collected Files[1] Folder	Files	Explanation
	dlmmgr-path.txt	Result of the dlnkmgr view -path -exlu command
	dlmmgr-path-iem.txt	Result of the dlnkmgr view -path -iem command
	dlmmgr-sys.txt	Result of the dlnkmgr view -sys command
	evApplication.evt evApplication.log	Event log for applications
	evSecurity.evt evSecurity.log	Event log for security
	evSystem.evt evSystem.log	Event log for the system
	HBA-reg.txt	Registry setting information of HBA
	hdlmdsm-status.txt	Filter driver information
	hntrlib-reg.txt	Contents of the HNTRLib registry
	iscsi-reg.txt	iscsi registry information
	mpio-list.txt	MPIO information
	mpio-reg.txt	MPIO registry information
	winmsd.txt	Windows system information
folder-to-which-collected-information-is-output\hbsainfo	All files under hbsainfo[8]	Error information of a HiCommand product other than HDLM

[1]The target error information collection folder is created in the folder to which collected information is output. The user specifies the folder to which collected information is output when executing DLMgetras. The default of *folder-to-which-collected-information-is-output* when the DLMgetras utility is executed from the Windows **Start** menu is *Windows-installation-destination-drive-name*\hdlmtemp\hdlmgetras_*nn*. *nn* is a number from 00 to 99. You can change the *Windows-installation-destination-drive-name*\hdlmtemp portion by changing the target in the **DLMGetras** properties.

[2]The underlined part indicates the folder specified during installation.

[3]The value *N* depends on the setting in the dlmwebagent.properties file. The default value is 2.

[4]*M.N* indicates the VxVM version. For example, 4.1 indicates Veritas Volume Manager 4.1. The applicable version is either 2.7, 3.0, 3.1, 4.0, 4.1, 4.2, or 4.3.

[5]In the Windows Server 2003 (IPF and x64), replace this part with Program Files (x86).

[6]In the actual file name, a file number is appended to *Integrated-trace-file-prefix specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility2*. For example, the default will be hntr21.log to hntr216.log. Note that the 2 following the integrated trace file prefix does not represent a file number.

[7]You can obtain dlm_iscsims.txt only when the iSCSI software was installed.

[8]You can obtain all files under hbsainfo only when the HiCommand product other than HDLM from which error information is to be collected is being used.

Manually Obtainable Error Information Files and How to Obtain Them

When the DLMgetras utility finishes normally, the KAPL10022-I message is displayed. Error information is not obtained in the following cases:

- When the KAPL10048-E message is displayed after execution of the DLMgetras utility finishes
- When the KAPL10022-I and KAPL10048-E messages are not displayed after execution of the DLMgetras utility finishes.

In the above cases, manually obtain the error information described in the table below, and then save it in a desired location. Table 8.2 shows the manually obtainable error information files and how to obtain them.

Table 8.2 Manually Obtainable Error Information Files and How to Obtain Them

Error Information	File	How to Obtain Files[1]
HDLM log	dlmgui*n*.log dlmgui_launcher*n*.log dlmmgr*n*.log dlmwebagent[1-*N*].log hcmdslicense2.log hdlmtr*n*.log hs_err_pid*nnnn*.log installhdlm.log	Obtain the HDLM log files that are in the following folder: *HDLM-installation-drive*:\Program Files\HITACHI\ DynamicLinkManager\log
	hdlmtr.mm	Obtain the hdlmtr.mm file that is in the following folder: *HDLM-installation-drive*:\Program Files\HITACHI \DynamicLinkManager\log\mmap
Configuration file	dlmmgr.xml dlmwebagent.properties	Obtain the configuration files that are in the following folder: *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\config
MSCS log	cluster.log	Obtain the files that are in the following folder and are specified in the environment variable ClusterLog: *Windows-installation-folder*\Cluster
VxVM log	All files under logs	Obtain all the files that are in the following folder: *VxVM-installation-folder*\logs
VCS log	All files under log	Obtain all the files that are in the following folder: *VCS-installation-folder*\log
Windows log	setupact.log setupapi.log setuperr.log	Obtain the log files in the following folder: *folder-to-which-Windows-is-introduced* (%SystemRoot%)
Integrated trace file (HNTRLib2)	hntr*n*.log[2]	Obtain the integrated trace files that are in the following folder: *HNTRLib2-installation-drive*:\Program Files[3]\HITACHI\HNTRLib2\spool
Integrated trace file (HNTRLib)	hntr[1-16].log	Obtain the integrated trace files that are in the following folder: *HNTRLib-installation-drive*:\Program Files\HITACHI\HNTRLib\spool

Error Information	File	How to Obtain Files[1]
Registry information	application-list.txt dlm-reg.txt HBA-reg.txt	Use a registry editor to output the registry information into a file. The following lists the registry keys for each file. When obtaining the HBA-reg.txt file, the registry keys below might not exist, depending on the environment you use. Only output existing registry keys into a file. ■ For application-list.txt: HKEY_LOCAL_MACHINE\SOFTWARE ■ For dlm-reg.txt: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet ■ For HBA-reg.txt: HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\ql2100 HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\ql2200 HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\ql2300 HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\elxsli2 HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\lp6nds35 HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\lpxnds HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\lpxftr HKEY_LOCAL_MACHINE\SYSTEM\SYSTEM\CurrentControlSet\Services\elxstor

Error Information	File	How to Obtain Files[1]
MSCS information	cluster-sys.txt	At the command prompt, execute all of the cluster commands listed below to output the results into the cluster-sys.txt file: ■ cluster /ver > cluster-sys.txt ■ cluster /QUORUM >> cluster-sys.txt ■ cluster /List >> cluster-sys.txt ■ cluster node >> cluster-sys.txt ■ cluster node /prop >> cluster-sys.txt ■ cluster node /priv >> cluster-sys.txt ■ cluster group >> cluster-sys.txt ■ cluster group /prop >> cluster-sys.txt ■ cluster group /priv >> cluster-sys.txt ■ cluster res >> cluster-sys.txt ■ cluster res /prop >> cluster-sys.txt ■ cluster res /priv >> cluster-sys.txt ■ cluster net >> cluster-sys.txt ■ cluster net /prop >> cluster-sys.txt ■ cluster net /priv >> cluster-sys.txt ■ cluster netint >> cluster-sys.txt ■ cluster netint /prop >> cluster-sys.txt ■ cluster netint /priv >> cluster-sys.txt ■ cluster restype /list >> cluster-sys.txt
iSCSI information	dlm_iscsims.txt[4]	At the command prompt, execute the following iSCSI utilities to output the results into each file: ■ iscsicli VersionInfo >> dlm_iscsims.txt ■ iscsicli ListPersistentTargets >> dlm_iscsims.txt ■ iscsicli ListTargetPortals >> dlm_iscsims.txt ■ iscsicli ListTargets >> dlm_iscsims.txt ■ iscsicli SessionList >> dlm_iscsims.txt
HDLM information	hdlmservicepack hdlmversion	Obtain the hdlmservicepack file, and the hdlmversion file that is in the following folder: *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager
	dlmgui_version	Obtain the dlmgui_version file that is in the following folder: *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\config

Error Information	File	How to Obtain Files[1]
	■ hdlmdsm-status.txt ■ dlmmemorytrace.txt ■ dlmmgr-lic.txt ■ dlmmgr-lu.txt ■ dlmmgr-lu-all.txt ■ dlmmgr-path.txt ■ dlmmgr-path-iem.txt ■ dlmmgr-sys.txt ■ hdlmdsm-status.txt ■ viewfile.txt	At the command prompt, execute the following commands to output the results into each file: ■ hdlmdsm-status.txt *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\hsptpdrv.exe aa > hdlmdsm-status.txt ■ dlmmemorytrace.txt *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\hsptpdrv.exe v > dlmmemorytrace.txt ■ dlmmgr-lic.txt dlnkmgr view -sys -lic > dlmmgr-lic.txt ■ dlmmgr-lu.txt dlnkmgr view -lu -item pn cp type ic ie dnu slpr clpr -exlu > dlmmgr-lu.txt ■ dlmmgr-lu-all.txt dlnkmgr view -lu -item all -exlu > dlmmgr-lu-all.txt ■ dlmmgr-path.txt dlnkmgr view -path -exlu > dlmmgr-path.txt ■ dlmmgr-path-iem.txt dlnkmgr view -path -iem > dlmmgr-path-iem.txt ■ dlmmgr-sys.txt dlnkmgr view -sys > dlmmgr-sys.txt ■ hdlmdsm-status.txt *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\hsptpdrv.exe aa > hdlmdsm-status.txt ■ viewfile.txt *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\viewfile.exe > viewfile.txt
All the folders and the list of files in the HDLM installation destination folder	■ dirHdlmRoot.txt	At the command prompt, execute the following commands to output the results into dirHdlmRoot.txt file. dir /s /a *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager > dirHdlmRoot.txt
Event log information	■ evApplication.evt ■ evApplication.txt ■ evSecurity.evt ■ evSecurity.txt ■ evSystem.evt ■ evSystem.txt	Open the event viewer, and then name and save each log file. For each log, save the following two types of files described below for each log file: ■ File A file whose type is event log (*.evt) ■ File A file whose type is text file (tab-delimited) (*.txt)

Error Information	File	How to Obtain Files[1]
MPIO information	mpio-list.txt	At the command prompt, execute the mpiolist command listed below to output the results into the mpio-list.txt file: ■ *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\mpiolist 0 > mpio-list.txt ■ *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\mpiolist 1 >> mpio-list.txt ■ *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\mpiolist 2 >> mpio-list.txt ■ *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\mpiolist 3 >> mpio-list.txt ■ *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\mpiolist 4 >> mpio-list.txt ■ *HDLM-installation-drive*:\Program Files\HITACHI\DynamicLinkManager\DLMTools\mpiolist 5 >> mpio-list.txt
Windows system information	winmsd.txt	At the command prompt, execute the winmsd command as follows. The winmsd.txt file is output to the folder where you execute the command: winmsd /report winmsd.txt
All the folders and the list of files in the Windows installation destination folder	dirSystemRoot.txt	At the command prompt, execute the following command to output the results into dirSystemRoot.txt file: dir /s /a %SystemRoot% > dirSystemRoot.txt

[1]The installation folders used in the *How to obtain the files* column indicate the default installation folder.

[2]In the actual file name, a file number is appended to *Integrated-trace-file-prefix specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility2*. For example, the default is hntr21.log to hntr216.log. Note that the 2 following the integrated trace file prefix does not represent a file number.

[3]In the Windows Server 2003 (IPF and x64), replace this part with Program Files (x86).

[4]You can obtain dlm_iscsims.txt only when the iSCSI software was installed.

8.3 The dlmpr Utility for Clearing HDLM Persistent Reservation

The `dlmpr` utility clears the persistent reservation left in the LU after HDLM is uninstalled. However, the persistent reservation is not left in the LU when you uninstall HDLM as instructed by the procedure in the manual. This utility is located in: *drive-where-installation-CD-ROM-is-being-inserted*\DLMTools\dlmpr.exe

Note: This utility can be executed when the following conditions are satisfied:

- HDLM has been uninstalled.
- Services and drivers in a cluster system have not started.

8.3.1 Format

```
dlmpr {-c| -d| -h}
```

8.3.2 Parameters

`-c`

Displays a list of the paths for LUs managed by HDLM and persistent reservation information. When you specify the path ID, the persistent reservation for the path is cleared.

`-d`

Displays a list of the paths for LUs managed by HDLM and persistent reservation information.

`-h`

Displays the help of this utility.

None

Displays an overview of this utility.

8.3.2.1 Clearing the Persistent Reservation in an MSCS Environment

To clear the persistent reservation in an environment in which MSCS is used:

1. Start a host from the hosts that make up the MSCS system.
2. Choose **Start, Settings, Control Panel**, double-click **Administrative Tool, and then double click Computer Management**. The Computer Management window is displayed.
3. Choose **Services and Applications** and then double-click **Services**. A list of services is displayed. From the list, choose **Cluster Service**, right-click it and choose **Properties**. In the **General** tab, select **Disabled** from the **Startup type** combo box **and then** click the **OK** button.
4. In the Computer Management window, choose **Device Manager**. From the **View** menu, select **Show hidden devices**. Choose **Cluster Disk Driver** from **Non-Plug and Play Drivers** in the right window, right-click it, and then choose **Disabled**. The message **Disabling this device will cause it to stop functioning. Do you really want to disable it?** is displayed: choose **Yes**. The message prompting you to restart the system is displayed again, choose **Yes**. The system restarts and the **Cluster Disk Driver** becomes disabled.
5. Execute `dlmpr -d`. The following shows what happens when this utility is executed. The persistent reservation remains when the KeyCount is not 0.

```
>dlmpr.exe -d
PathID PathName                              KeyCount
ReservedKey       Type
000000 0001.0000.0000000000000000.0000     1    200000E08B1059EC
ExclusiveAccessRegistrantOnly
000001 0001.0000.0000000000000000.0001     1    200000E08B1059EC
ExclusiveAccessRegistrantOnly
KAPL10640-I The dlmpr utility completed normally.
```

6. Execute `dlmpr -c`. From the displayed list, enter the path ID where KeyCount is not 0. The confirmation message is displayed twice. Check the message and enter `y`. The persistent reservation is cleared. Repeat the procedure until KeyCount for all paths is changed to 0. The following shows what happens in executing this utility.

```
>dlmpr.exe -c
PathID PathName                              KeyCount
ReservedKey       Type
000000 0001.0000.0000000000000000.0000     1    200000E08B1059EC
ExclusiveAccessRegistrantOnly
000001 0001.0000.0000000000000000.0001     1    200000E08B1059EC
ExclusiveAccessRegistrantOnly
KAPL10655-I Specify the PathID of the LU for which you want to clear persistent
reservation information. (To cancel, press the x key):0
KAPL10656-I The persistent reservation information of PathID = 0 will be cleared.
Is this OK? [y/n]:y
KAPL10657-I If you continue this process, the reservation of the LU you specified
will be cleared. Please confirm that no other servers are accessing this LU.
[y/n]:y
KAPL10658-I The persistent reservation information of PathID = 0 was cleared.
KAPL10640-I The dlmpr utility completed normally.
```

7. Choose **Start, Settings, Control Panel**, double-click **Administrative Tool, and then double-click Computer Management**. The Computer Management window is displayed.
8. Choose **Services and Applications** and then double-click **Services**. A list of services is displayed. From the list, right-click **Cluster Service**, and then choose Properties. Select **Automatic** from the **Startup type** combo box in the **General** tab, and then click **OK** button.
9. In the Computer Management window, choose **Device Manager**. From the **View** menu, select **Show hidden devices**. Choose **Cluster Disk Driver** from **Non-Plug and Play Drivers** on the right window, right-click it, and choose **Enabled**. The message prompting you to restart the system is displayed again. Choose **Yes**. The system restarts and the **Cluster Disk Driver** becomes enabled.
10. Make sure that MSCS starts correctly.
11. Start another host from the hosts that make up the MSCS system.

8.3.2.2 Clearing the Persistent Reservation in a VCS Environment

To clear the persistent reservation in an environment in which VCS is used:

1. Start one host from the hosts that make up the VCS system.
2. Stop the VCS.
3. Execute `dlmpr -d`.
4. Execute `dlmpr -c`.
5. From the displayed list, enter the path ID where KeyCount is not 0. The confirmation message is displayed twice. Check the message and enter `y`. The persistent reservation is cleared. Repeat the procedure until KeyCount for all paths is changed to 0.
6. Restart the VCS.
7. Restart the VCS, or start another host from the hosts that make up the VCS system.

8.4 The dlmprsvkey Utility for Registering an HDLM Persistent Reservation Key

This utility registers and displays a persistent reservation key on the HDLM host. A persistent reservation key is required to operate HDLM functions normally. This utility is executed automatically at installation of HDLM. A registered persistent reservation key becomes valid after the host is rebooted. This utility is located in the following:

HDLM-installation-folder\bin\dlmprsvkey.exe

8.4.1 Format

```
dlmprsvkey {-r [persistent-reservation-key-to-be-specified-by-user][-s]| -v
| -h}
```

8.4.2 Parameters

Specify the -r [*persistent-reservation-key-to-be-specified-by-user*][-s] parameter when you register a persistent reservation key: *persistent-reservation-key-to-be-specified-by-user.*

A maximum of 16 hexadecimal alphanumeric digits can be specified.

- If this parameter is omitted, or the dlmprsvkey utility is automatically executed during HDLM installation:

  The dlmprsvkey utility for registering the HDLM persistent reservation key creates a persistent reservation key by using the MAC address of the NIC and the execution time of the utility. If the MAC address of the NIC cannot be obtained, the dlmprsvkey utility creates a persistent reservation key by using the execution time of the utility only.

- If this parameter is specified:

  If a value less than 16 digits is specified, zeros are added to the left of the entered value to make up the 16 digits. The specified value must satisfy both of the following conditions:

  - Must be a unique value for hosts in SAN.
  - Specifiable values are single-byte characters from 0 to 9, a to f, and A to F. Values cannot be specified using zeroes only. In the following example, the utility registers the PRSV key without specifying it on the host:

```
>dlmprsvkey -r
KAPL12104-I  The operation for PRSV key registration will now start. Is this
OK? [y/n]: y
KAPL12106-I  An attempt to register the PRSV key was successful. (PRSV key =
0123456789abcdef)
```

  In the following example, the utility registers the PRSV key by specifying it on the host:

```
>dlmprsvkey -r 0123456789ABCDEF
KAPL12104-I  The operation for PRSV key registration will now start. Is this
OK? [y/n]: y
```

```
KAPL12106-I  An attempt to register the PRSV key was successful. (PRSV key =
0123456789abcdef)
```

- Specify the `-s` parameter to display no confirmation message on execution of the `dlmprsvkey` utility.
- Specify the `-v` parameter to display the registered persistent reservation key.

  Example:

```
>dlmprsvkey -v
KAPL12116-I  The registered PRSV key will now be displayed. (PRSV key =
0123456789abcdef)
```

- Specify the `-h` parameter to display the help for this utility.
- Specify the `None` parameter to display the alert message.

8.5 The dlmchkpath Utility for Checking HDLM Paths

If you install or uninstall HDLM in a multi-path configuration, the disk contents might no longer be correct. Use the `dlmchkpath` utility for checking HDLM paths to make sure that the system is in a single-path configuration. During upgrade installation or re-installation of HDLM, the `dlmchkpath` utility is executed automatically. If the system is in a single-path configuration, the `dlmchkpath` utility displays nothing during upgrade installation or re-installation of HDLM. A warning dialog box appears if the system is in a multi-path configuration.

However, when you use one of the following methods to install HDLM and the system is determined to be a multi-path configuration, installation will terminate without displaying any warning dialog boxes:

- Upgrade installation using the unattended installation
- Re-installation using the unattended installation

When the `dlmchkpath` utility is manually executed, a message appears as shown in the execution example shown in section 8.5.2. This utility is in the following location:

HDLM-*installation-folder*`\bin\dlmchkpath.exe`

8.5.1 Format

```
dlmchkpath {-singleconnect | -h}
```

8.5.2 Parameters

The `-singleconnect` parameter checks whether a single path connects the HDLM management-target LU and the host.

In the following example, the utility determines that the system is in a single-path configuration:

```
>dlmchkpath -singleconnect
KAPL12401-I All LUs managed by HDLM are in a single path configuration.
```

In the following example, the utility determines that the system is in a multi-path configuration:

```
>dlmchkpath -singleconnect
KAPL12402-W iLU(0100) is in a multi-path configuration. PathID = 0,3
KAPL12402-W iLU(0101) is in a multi-path configuration. PathID = 1,4
KAPL12402-W iLU(0102) is in a multi-path configuration. PathID = 5,2
```

In the following example, the `view` operation is performed when the utility determines that the system is in a multi-path configuration. For details about the `view` operation, see section 7.7.

```
>dlnkmgr view -path -c
Paths:000006 OnlinePaths:000006
PathStatus   IO-Count    IO-Errors
Online         152579       30

PathID DskName                              iLU              CP Status     Type
000000 HITACHI .DF600F    .5455        0100             0C Online     Own
000001 HITACHI .DF600F    .5455        0101             0C Online     Own
000002 HITACHI .DF600F    .5455        0102             0C Online     Non
000003 HITACHI .DF600F    .5455        0100             1C Online     Non
000004 HITACHI .DF600F    .5455        0101             1C Online     Non
000005 HITACHI .DF600F    .5455        0102             1C Online     Own
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
```

The `-h` parameter displays the help for the dlmchkpath utility.

The `None` parameter displays an alert message.

Chapter 9 Messages

This chapter describes the format and meaning of message IDs, terms used in messages and in message explanations, HDLM messages, and appropriate actions to take in response to the messages. Section 9.16 describes the meanings and actions to be taken of return codes output by HDLM when the HDLM remote access interface sends a request to HDLM.

- Before viewing the list of messages (see section 9.1)
- HDLM command messages (see section 9.2)
- HDLM GUI messages (see section 9.3)
- HDLM API messages (see section 9.4)
- HDLM manager messages (see section 9.5)
- HDLM driver (Filter Component) messages (see section 9.6)
- HDLM driver (Core Logic Component) messages (see section 9.7)
- HDLM management target messages (see section 9.8)
- HDLM installation program messages (see section 9.9)
- Messages from the DLMgetras utility (see section 9.10)
- Messages from the dlmpr utility (see section 9.11)
- Messages from the HDLM remote access interface (see section 9.12)
- Messages from the dlmprsvkey utility (see section 9.13)
- Messages from the HDLM Performance Monitor (see section 9.14)
- Messages from the dlmchkpath utility (see section 9.15)
- Return Codes for the HDLM remote access Interface (see section 9.16)

9.1 Before Viewing the List of Messages

This section explains the following information that is needed to locate messages and understand the message explanations in the sections from 9.2.

- Format and meaning of message IDs
- Terms used in messages and message explanations
- Message language

9.1.1 Format and Meaning of Message IDs

Each message has a message ID. Table 9.1 shows the format and meaning of message IDs.

Table 9.1 Format and Meaning of ID KAPL*mmnnn-l* Message

Format	Meaning
KAPL	Indicates that the message is an HDLM message.
mm	Number of the HDLM module that issued the message: ■ 01: HDLM command ■ 02: HDLM GUI ■ 03: HDLM API ■ 04: HDLM manager ■ 05: HDLM driver (filter component) ■ 07: HDLM driver (core logic component) ■ 08: HDLM management target ■ 09: HDLM installation program ■ 10: The following utilities: DLMgetras utility (KAPL100*nn*) dlmpr utility (KAPL106*nn*) ■ 11: HDLM remote access interface ■ 12: dlmprsvkey utility (KAPL121*nn*), HDLM Performance Monitor (KAPL1215*n*), dlmchkpath utility (KAPL124*nn*)
nnn	Message serial number for the module
l	Message level: ■ C: Critical ■ E: Error ■ W: Warning ■ I: Information

9.1.2 Terms Used in Messages and Message Explanations

Table 9.2 shows the terms that may appear in messages and message explanations.

Table 9.2 Terms Used in Messages and Message Explanations

Terms	Meaning
aa...aa	Variable (If a message contains two or more variables, they are displayed as *bb...bb*, *cc...cc*, and so on.)
FO	Failover
Operation name	Type of the operation that is entered after `dlnkmgr` in the command.
Service status	Running status of the service
Mounted drive	A drive that the file system recognizes

9.2 HDLM Command (dlnkmgr and Operations) Messages

Message ID	Message	Details and Actions
KAPL01001-I	The HDLM command completed normally. Operation name = *aa...aa*, completion time = *bb...bb*	Details The HDLM command completed successfully. *aa...aa*: clear, help, offline, online, set, view *bb...bb:* the year of grace/month/day hour:minute:second Action None.
KAPL01002-I	The HDLM command started. Operation name = *aa...aa*	Details The HDLM command was executed. *aa...aa*: clear, offline, online, set, view Action None.
KAPL01003-W	No operation name is specified.	Details The operation name is missing. Action Specify the operation name, and then retry.
KAPL01004-W	The operation name is invalid. Operation name = *aa...aa*	Details *aa...aa*: Specified operation name Action Execute the help operation of the HDLM command (dlnkmgr) to check the operation name, and then retry. For details on the help operation, see section 7.3.
KAPL01005-W	A parameter is invalid. Operation name = *aa...aa*, parameter = *bb...bb*	Details *aa...aa*: clear, set, online, offline, view *bb...bb*: Specified parameter Action Execute help *operation-name* of the HDLM command (dlnkmgr) to check the parameter, and then retry. For details on the help operation, see section 7.3.
KAPL01006-W	A necessary parameter is not specified. Operation name = *aa...aa*	Details The specified operation does not contain the necessary parameter. *aa...aa*: clear, set, offline, view Action Execute help *operation-name* of the HDLM command (dlnkmgr) to check the parameter. Specify the correct parameter, and then retry. For details on the help operation, see section 7.3.

Message ID	Message	Details and Actions
KAPL01007-W	A duplicate parameter is specified. Operation name = *aa...aa*, parameter = *bb...bb*	Details *aa...aa*: clear, offline, online, set, view *bb...bb*: Duplicate parameter Action Delete the duplicate parameter, and then retry.
KAPL01008-W	A necessary parameter value is not specified. Operation name = *aa...aa*, parameter = *bb...bb*	Details *aa...aa*: offline, online, set, view *bb...bb*: Parameter name Action Specify the parameter value, and then retry.
KAPL01009-W	A parameter value is invalid. Operation name = *aa...aa*, parameter = *bb...bb*, parameter value = *cc...cc*, Valid value = *dd...dd*	Details *aa...aa*: offline, online, set, view *bb...bb*: Parameter name *cc...cc*: Specified parameter value *dd...dd*: Specifiable parameter value range Action Specify the correct value for the parameter, and then retry.
KAPL01012-E	Could not connect the HDLM manager. Operation name = *aa...aa*	Details In the view –sys –sfunc operation, information must be collected from the HDLM manager but the manager cannot be accessed. *aa...aa*: view Action Execute the view operation of the HDLM command (dlnkmgr) to check whether the HDLM manager has started. Start the HDLM manager if it has not started, and then retry the HDLM command. For details on the view operation, see section 7.7.
KAPL01013-E	An error occurred in internal processing of the HDLM command. Operation name = *aa...aa* details = *bb...bb*	Details An error whose cause does not seem to be a user operation occurred during command processing. *aa...aa:* clear, offline, online, set, view *bb...bb*: Function name and contents of error Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL01014-W	No authority to execute the HDLM command. Operation name = *aa...aa*	Details You are not authorized to execute the HDLM command as the administrator. *aa...aa*: clear, offline, online, set, view Action Execute the command as a user with administrators group privileges.
KAPL01015-W	The target HBA was not found. Operation name = *aa...aa*	Details The path having the port number and path number specified in the -hba parameter could not be found. *aa...aa*: offline, online Action Execute the view operation of the HDLM command (dlnkmgr view -path) and check the value displayed in PathName. Specify the two leftmost digits of PathName for the relevant HBA port, and then retry. For details on the view operation, see section 7.7.
KAPL01016-W	The target CHA port was not found. Operation name = *aa...aa*	Details The path ID indicated by -pathid and required by the -cha parameter is not an object of HDLM management. *aa...aa*: offline, online Action Execute the view operation of the HDLM command (dlnkmgr view -path) and then check the value displayed in ChaPort. Specify the PathID of a path that passes through the relevant CHA port, and then retry. For details on the view operation, see section 7.7.
KAPL01018-W	The target device was not found. Operation name = *aa...aa*	Details The specified host device name could not be found. *aa...aa*: view Action Execute the view operation of the HDLM command (dlnkmgr view -path) to check the value displayed in HDevName. Specify the value of HDevName for the host device to be operated and then retry. For details on the view operation, see section 7.7.

Message ID	Message	Details and Actions
KAPL01019-W	The target path was not found. Operation name = *aa...aa*	Details *aa...aa*: offline, online, view ■ offline/online operation The specified path does not exist. ■ view operation The paths have not been configured because creation of the HDLM environment or configuration changes to the HDLM operating environment have not finished. Action ■ offline/online operation Use the view operation of the HDLM command (dlnkmgr) to check the specification, and then retry. For details on the view operation, see section 7.7. ■ view operation Refer to Chapter 3. or section 4.6, and then configure the path. If the same error occurs again, execute the DLMgetras utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company with which you have a service contract. For details on the DLMgetras utility, see section 8.2.
KAPL01021-E	Cannot execute the HDLM command due to insufficient memory.	Details Memory required for HDLM command processing could not be allocated. Action Terminate unnecessary applications to increase the amount of free memory, and then try again.
KAPL01023-W	The last Online path for the device cannot be placed Offline(C).	Details The path specified in the offline operation cannot be placed Offline(C) because it is the last path of the LU. Action Use the view operation of the HDLM command (dlnkmgr) to check the status of the path. For details on the view operation, see section 7.7.
KAPL01024-W	The specified parameters cannot be specified at the same time. Operation name = *aa...aa*, parameters = *bb...bb*	Details *aa...aa*: offline, online, set, view *bb...bb*: Parameters cannot be specified at the same time Action Execute help *operation-name* of the HDLM command (dlnkmgr) to check the parameter that can be specified, and then retry. For details on the help operation, see section 7.3.

Message ID	Message	Details and Actions
KAPL01035-W	The cluster support function is active, so the load balancing function is not supported.	Details The load balancing function cannot be enabled because MSCS is installed. Action The load balancing function is not supported in an environment with MSCS installed. If you want to use the load balancing function, uninstall MSCS.
KAPL01036-E	The Offline path cannot be placed online. PathID = *aa...aa*	Details The path could not be recovered. *aa...aa*: Path ID (decimal number) Action Remove the error in the path, and then retry.
KAPL01039-W	During the online operation processing of the HDLM command, a path that cannot be placed in the Online status was detected. PathID = *aa...aa* Would you like to continue the processing of the online operation? [y/n]:	Details A path that cannot be placed Online was detected during multi-path online processing. To ignore this path and perform online processing for the next path, enter `y`. To cancel processing, enter `n`. *aa...aa*: Path ID (decimal number) Action If you want to continue processing of the `online` operation of the HDLM command for other paths, enter `y`. If you want to terminate the processing, enter `n`. For details on the `online` operation, see section 7.5.
KAPL01040-W	The entered value is invalid. Re-enter [y/n]:	Details A value other than y and n was entered. Enter y or n. Action Enter `y` or `n`.
KAPL01041-E	The entered value is invalid. The operation stops. Operation name = *aa...aa*	Details Command processing will be aborted because an incorrect response was made three times in reply to the request. *aa...aa*: `clear`, `offline`, `online`, `set` Action To execute the operation, re-execute the HDLM command.
KAPL01044-W	A duplicate parameter value is specified. Operation name = *aa...aa*, parameter = *bb...bb*, parameter value = *cc...cc*	Details The same parameter value is specified two or more times. *aa...aa*: `view` *bb...bb*: Parameter name *cc...cc*: Duplicated parameter value Action Delete the duplicate parameter value name, and then retry.

Message ID	Message	Details and Actions
KAPL01045-W	Too many parameter values are specified. Operation name = *aa...aa*, parameters = *bb...bb*, parameter value = *cc...cc*	Details *aa...aa*: offline, online, set, view *bb...bb*: Parameter name *cc...cc*: Parameter value Action Execute help *operation-name* of the HDLM command (dlnkmgr) to check the parameter value, and then retry. For details on the help operation, see section 7.3.
KAPL01046-I	An offline request was registered in a batch job. PathID = *aa...aa*	Details The offline command was executed but the path is currently processing. If the view -path operation is executed in this status, Offline(P) is displayed. Wait a while, and then re-execute the view -path operation to make sure that the status is Offline(C). *aa...aa*: Path ID (decimal number) Action None.
KAPL01047-W	Only one offline request can be registered in a batch job.	Details The offline command cannot be accepted because offline processing is currently being performed. Action Wait until the offline request registered in the batch job finishes, and then retry.
KAPL01048-W	Help information cannot be found. Operation name = *aa...aa*.	Details The specified operation is not an operation of the HDLM command. *aa...aa*: Specified operation name Action Use the help operation of the HDLM command (dlnkmgr) to check the operation name. And then retry. For details on the help operation, see section 7.3.
KAPL01049-I	Would you like to execute the operation? Operation name = *aa...aa* [y/n]:	Details The clear/set operation will be started. To continue the operation, enter y. To cancel the operation, enter n. *aa...aa*: clear, set Action If you want to execute operation of the HDLM command, enter y. If you want to terminate the processing, enter n. For details on the clear operation, see section 7.2. For details on the set operation, see section 7.6.

Message ID	Message	Details and Actions
KAPL01050-I	The currently selected paths will be changed to the Online status. Is this OK? [y/n]:	Details The `online` operation will be started. To continue the `online` operation, enter `y`. To cancel the operation, enter `n`. Action If you want to execute the online processing, enter `y`. If you want to terminate the processing, enter `n`. For details on the `online` operation, see section 7.5.
KAPL01051-I	Because no path has been selected among the currently displayed paths, the paths in the Offline(C), Offline(E), and Online(E) statuses will be changed to the Online status. Is this OK? [y/n]:	Details All the paths will be placed Online because the path selection parameter is not specified in the `online` operation. To place all the paths Online, enter `y`. To not place them online, enter `n`. Action If you want to execute the online processing, enter `y`. If you want to terminate the processing, enter `n`. For details on the `view` operation, see section 7.7. For details on the `online` operation, see section 7.5.
KAPL01052-I	The currently selected paths will be changed to the Offline(C) status. Is this OK? [y/n]:	Details The `offline` operation will be started. To continue the `offline` operation, enter `y`. To cancel the operation, enter `n`. Action If you want to execute the offline processing, enter `y`. If you want to terminate the processing, enter `n`. For details on the `offline` operation, see section 7.4.
KAPL01053-I	If you are sure that there would be no problem when the path is placed in the Offline(C) status, enter y. Otherwise, enter n. [y/n]:	Details The `offline` operation will be started. To continue the `offline` operation, enter `y`. To cancel the operation, enter `n`. Action If you want to execute the offline processing, enter `y`. If you want to terminate the processing, enter `n`. For details on the `offline` operation, see section 7.4.
KAPL01054-W	During the offline operation processing of the HDLM command, a path that cannot be placed in the Offline(C) status was detected. PathID = *aa...aa* Would you like to continue the processing of the offline operation? [y/n]:	Details A path that cannot be placed Offline(C) was detected during multi-path offline processing. To ignore this path and perform offline processing for the next path, enter `y`. To cancel offline processing, enter `n`. *aa...aa*: Path ID (decimal number) Action If you want to continue processing of the `offline` operation of the HDLM command for other paths, enter `y`. If you want to terminate the processing, enter `n`. For details on the `offline` operation, see section 7.4.

Message ID	Message	Details and Actions
KAPL01055-I	All the paths which pass the specified *aa...aa* will be changed to the Offline(C) status. Is this OK? [y/n]:	Details Multiple paths will be collectively placed Offline(C) because the -hba or -cha parameter was specified. To collectively place multiple paths Offline(C), enter y. To not collectively place them Offline(C), enter n. *aa...aa*: cha port or hba Action If you want to execute the offline processing for the paths that pass the specified target, enter y. If you want to terminate the processing, enter n.
KAPL01056-I	If you are sure that there would be no problem when all the paths which pass the specified *aa...aa* are placed in the Offline(C) status, enter y. Otherwise, enter n. [y/n]:	Details This message re-asks the user whether to place all the paths Offline(C). To place all the paths Offline(C), enter y. To not place them Offline(C), enter n. *aa...aa*: cha port or hba Action If you want to execute the offline processing for the paths that pass the specified target, enter y. If you want to terminate the processing, enter n.
KAPL01057-I	All the paths which pass the specified *aa...aa* will be changed to the Online status. Is this OK? [y/n]:	Details Multiple paths will be collectively placed Online because the -hba or -cha parameter has been specified. To continue processing, enter y. To cancel processing, enter n. *aa...aa*: cha port or hba Action If you want to execute the online processing for the paths that pass the specified target, enter y. If you want to terminate the processing, enter n.
KAPL01058-W	The specified parameter value is not needed. Operation name = *aa...aa*, parameter = *bb...bb*, parameter value = *cc...cc*	Details A parameter value was specified in a parameter that does not need any parameter value. *aa...aa*: clear, offline, online, set, view *bb...bb*: Parameter name *cc...cc*: Parameter value Action Execute help *operation-name* of the HDLM command (dlnkmgr) to check the parameter and parameter value, and then retry. For details on the help operation, see section 7.3.

Message ID	Message	Details and Actions
KAPL01059-W	Cannot specify the parameter *aa...aa* at the same time if you specify parameter *bb...bb* and parameter value *cc...cc*. Operation name = *dd...dd*	Details A parameter value conflicts with the specification of another parameter. *bb...bb*: Parameter name *cc...cc*: Parameter value *aa...aa*: Parameter name *dd...dd*: view, set Action Execute help *operation-name* of the HDLM command (dlnkmgr) to check the parameter and parameter value, and then retry. For details on the help operation, see section 7.3.
KAPL01060-I	The user terminated the operation. Operation name = *aa...aa*	Details The command processing will be aborted because n was entered in reply to the acknowledgment. *aa...aa*: online, offline, set, clear Action None.
KAPL01061-I	*aa...aa* path(s) were successfully placed *bb...bb*; *cc...cc* path(s) were not. Operation name = *dd...dd*	Details This message indicates the number of the paths processed in the online/offline operation. *aa...aa*: Number of paths where online/offline operation is successful (decimal number) *bb...bb*: Online or Offline(C) *cc...cc*: Number of paths where online/offline is unsuccessful (decimal number) *dd...dd*: online, offline Action None. For details on the online operation, see section 7.5. For details on the offline operation, see section 7.4.

Message ID	Message	Details and Actions
KAPL01062-I	*aa...aa* path(s) were successfully placed Offline(C). The offline request of *bb...bb* path(s) were registered; *cc...cc* path(s) were not. Operation name = *dd...dd*	Details This message indicates the number of paths that were processing when the offline request was registered during Reserve processing. *aa...aa*: Number of paths where offline is successful (decimal number) *bb...bb*: Number of paths for which offline was reserved (decimal number) *cc...cc*: Number of paths where offline is unsuccessful (decimal number) *dd...dd*: offline Action For batch registered paths, execute the `view` operation to check the registered path(s). For details on the `view` operation, see section 7.7.
KAPL01063-I	The target path(s) are already *aa...aa*.	Details As a result of executing the `online`/`offline` operation, the specified path is already placed Online/Offline(C). *aa...aa*: Online or Offline(C) Action Use the `view` operation of the HDLM command (`dlnkmgr`) to check the status of the path. For details on the `view` operation, see section 7.7. For details on the `online` operation, see section 7.5. For details on the `offline` operation, see section 7.4.
KAPL01064-W	The information for the specified host device could not be acquired. Operation name = *aa...aa*	Details The host device specified in `view -path -hdev` cannot currently be accessed. *aa...aa*: view Action ■ If the specified host device is being formatted, retry after formatting finishes. ■ If all the paths to the specified host device contain an error, recover the path error, and then retry. ■ In a cluster configuration, if the LU existing for the specified host device is exclusively used from another host, or if the specified host device is allocated for a dynamic disk volume, you cannot view the path information by specifying the host device name. Re-execute the `dlnkmgr` command's `view` operation without specifying the host device name.

Message ID	Message	Details and Actions
KAPL01065-E	The configuration does not support the simultaneous use of the load balancing and cluster support functions.	Details If a storage system for which persistent reserve is not supported exists among the HDLM-managed storage systems, the load balancing function cannot be used in the cluster environment. Action Make sure that all HDLM-managed storage systems support persistent reserve. Contact your storage system vendor or maintenance company to check whether the storage systems you are using support persistent reserve.
KAPL01068-I	Enter a license key:	Details The license key will now be renewed. Enter a license key. Action None.
KAPL01069-W	The entered license key is invalid.	Details The entered license key is invalid. Action Enter a valid license key.
KAPL01070-E	The entered license key is invalid. Renewal of the license key will now stop.	Details The license key renewal will be aborted because an invalid license key was entered three times. Action Obtain a valid license key, and then retry.
KAPL01071-I	The permanent license was installed.	Details The license was renewed into a permanent license. Action None.
KAPL01072-I	The emergency license was installed. The license expires on *aa...aa*.	Details A license was renewed into the emergency license. *aa...aa*: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31) Action Install a permanent license by the expiration day.
KAPL01073-E	The temporary license expired.	Details The temporary license expired. Register a permanent license. Action Register a permanent license.

Message ID	Message	Details and Actions
KAPL01074-E	The emergency license expired.	Details The emergency license expired. Register a permanent license. Action Register a permanent license.
KAPL01075-E	A fatal error occurred in HDLM. The system environment is invalid.	Details A part of the HDLM configuration file is missing. Action Re-install HDLM.
KAPL01076-I	The permanent license has been installed.	Details You do not need to install a license because a permanent license has already been installed. Action None.
KAPL01079-W	The intermittent error monitoring function cannot be set up because automatic failback is disabled.	Details The intermittent error monitoring function cannot be set up because automatic failback is disabled. Action Enable automatic failback, and then re-execute.
KAPL01080-W	The error monitoring interval and the number of times that the error is to occur conflict with the automatic failback checking interval.	Details An intermittent error cannot be detected by using the values specified for the following: the checking interval for automatic failback, the error monitoring interval, and the number of times the error is to occur. Action Set the intermittent error monitoring interval to a value that is equal to or more than (*automatic-failback-checking-interval* x *number-of-times-error-is-to-occur-for-intermittent-error-monitoring*).
KAPL01081-E	The license key file is invalid. File name = *aa...aa*	Details The format of the license key file is invalid. *aa...aa*: *Windows-installation-destination-drive-name*:\hdlm_license Action Store the license key file directly under the Windows installation-destination drive.

Message ID	Message	Details and Actions
KAPL01082-E	There is no installable license key in the license key file. File name = *aa...aa*	Details There is no HDLM-installable license key in the license key file. *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license Action Make sure that the license key file is correct, and then re-execute.
KAPL01083-I	There is no license key file. File name = *aa...aa*	Details There is no license key file in the designated directory: *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license Action When the message that prompts you to enter the license key is displayed, enter the license key. Alternatively, cancel the HDLM command, store the license key file directly under the Windows installation-destination drive, and then re-execute HDLM command.
KAPL01084-W	An attempt to delete the license key file has failed. File name = *aa...aa*	Details *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license Action If a license key file exists, delete it.
KAPL01088-W	The specified parameter values cannot be specified at the same time. Operation name = *aa...aa*, parameter = *bb...bb*, parameter values = *cc...cc*	Details *aa...aa*: view *bb...bb*: Parameter name *cc...cc*: Parameter values cannot be specified at the same time Action Execute help *operation-name* of the HDLM command (dlnkmgr) to check the parameter that can be specified, and then retry. For details on the help operation, see section 7.3.

Message ID	Message	Details and Actions
KAPL01089-E	One of the following was executed at the same time as an HDLM command set -lic operation: another set -lic operation, or an update of the license for an update installation.	Action Check the license by using the HDLM command's `view -sys -lic` operation. Then, if necessary, re-execute the HDLM command's `set -lic` operation. If the same error message is output, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. Do not perform the following operations: ■ Simultaneous executions of the HDLM command's `set -lic` operation ■ Execution of the HDLM command's `set -lic` operation simultaneously with an update of the license for an update installation (an upgrade or re-installation)
KAPL01095-E	An attempt to acquire the HDLM version information has failed. details = *aa...aa*	Details *aa...aa*: Code showing reason for error Action Re-execute. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company for which you have a service contract.
KAPL01096-E	An attempt to acquire the Service Pack version information has failed. details = *aa...aa*	Details *aa...aa*: Code showing reason for error Action Re-execute. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company for which you have a service contract.
KAPL01097-W	All the current trace files will be deleted. Is this OK? [y/n]	Details If you set a value less than the current value of the trace file size or number of trace files, all the current trace files will be deleted. To continue the operation, enter `y`. To cancel the operation, enter `n`. Action If you want to execute operation of the HDLM command, enter `y`. If you want to terminate the processing, enter `n`.

Message ID	Message	Details and Actions
KAPL01098-W	The storage system (*aa...aa*, *bb...bb*) cannot perform the *cc...cc* operation in units of CHA ports.	Details Processing to place all paths Offline or Online via a specific CHA port cannot be performed on the EMC DMX series, the EMC CX series, and the HP EVA series. *aa...aa*: Vendor ID *bb...bb*: Product ID *cc...cc*: online/offline Action Execute, in units of paths, on a path that goes through the CHA port of the specified storage system.
KAPL01100-I	*aa...aa*	*Details* *This message indicates the executed command line.* *Action* *None.*
KAPL01106-W	One or more connected storage system cannot use the load balancing function.	Action None.
KAPL01107-I	The load balancing type specified for individual LUs will become invalid when this operation is executed. Do you want to execute the operation anyway? Operation name = set [y/n]:	Action If you want to set the load balancing type for the system, enter y. If you want to terminate the processing, enter n.

9.3 HDLM GUI Messages

Message ID	Message	Details and Actions
KAPL02001-I	HDLM GUI has started normally.	Action None.
KAPL02002-I	HDLM GUI has terminated.	Action None.
KAPL02003-E	You lack permission to start HDLM GUI.	Action Execute the command as a user with administrators group privileges.
KAPL02004-E	An error occurred during internal processing of HDLM GUI. HDLM GUI cannot start. Details = *aa...aa*	Details During GUI startup, an error that might not be caused by a user operation occurred. *aa...aa*: Failed API name: ■ JHSPGetPathBy ■ JHSPGetManagerStatus ■ JHSPGetDriverStatus ■ JHSPGetADriverStatus ■ JHSPVerifyAuthorization Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL02005-E	An attempt to start HDLM GUI has failed due to insufficient memory.	Details Sufficient memory to process the HDLM GUI could not be obtained. Action Terminate unnecessary applications to increase the amount of free memory, or restart the host.
KAPL02006-W	No path was detected.	Details The target path could not found. Action Set up a path between the host and storage system, and then restart the host.

Message ID	Message	Details and Actions
KAPL02007-E	The HDLM manager could not be connected. The *aa...aa* operation has been stopped.	Details During the Option window startup or Set Option Information operation, the system could not access the HDLM manager. *aa...aa*: Get Option Information or Set Option Information Action Execute the `view` operation of the HDLM command (`dlnkmgr`) to check whether the HDLM manager has started. If the HDLM manager has not started, start the HDLM manager and then restart HDLM GUI. For details on the `view` operation, see section 7.7.
KAPL02011-I	Would you like to execute the *aa...aa* operation? [OK/Cancel]	Details This is confirmation for execution of the operation. If you want to execute the operation, click **OK**. To cancel the operation, click **Cancel**. *aa...aa*: Clear Data Action If you want to execute the operation, click **OK**. To cancel the operation, click **Cancel**.
KAPL02012-I	*aa...aa* has started.	Details *aa...aa*: Operation ■ CSV Output ■ Set Option Information ■ Refresh ■ Online ■ Offline ■ Clear Data Action None.
KAPL02013-I	*aa...aa* has completed successfully.	Details *aa...aa*: Operation ■ CSV Output ■ Define Option Information ■ Refresh ■ Clear Data Action None.

Message ID	Message	Details and Actions
KAPL02014-W	No data has been input in *aa...aa*.	Details No value has been entered in the input field of the Option window. *aa...aa*: Input item ■ Path Health Checking Interval ■ Auto Failback Checking Interval ■ Error Log File Size ■ Monitoring Interval ■ Number of times ■ Error Log Number of Files ■ Trace File Size ■ Trace Number of Files Action Data has not been input for the specified item. See section 6.3 to specify a numeric value within the valid range described in this manual.
KAPL02015-W	A value which is not a number has been input in *aa...aa*.	Details Non-numeric value has been entered in the input field of the Option window. *aa...aa*: Input item ■ Path Health Checking Interval ■ Auto Failback Checking Interval ■ Error Log File Size ■ Monitoring Interval ■ Number of times ■ Error Log Number of Files ■ Trace File Size ■ Trace Number of Files Action Specify a numeric value for the specified item.

Message ID	Message	Details and Actions
KAPL02016-W	A value which is outside of the valid range has been input in *aa...aa*.	Details The value entered in the input field of the Option window is not within the valid range. *aa...aa*: Input item ■ Path Health Checking Interval ■ Auto Failback Checking Interval ■ Error Log File Size ■ Monitoring Interval ■ Number of times ■ Error Log Number of Files ■ Trace File Size ■ Trace Number of Files Action For the specified item, specify a numeric value within the valid range described in this manual. See section 6.3 to specify a numeric value within the valid range described in this manual.
KAPL02017-I	The currently selected paths will be changed to the Online status. Is this OK? [OK/Cancel]	Details The currently selected paths will be changed to the Online status. If you want to continue, click **OK**. If you do not want to proceed, click **Cancel**. Action If you want to execute the online processing, click **OK**. To cancel the online processing, click **Cancel**.
KAPL02018-I	Because no path has been selected among the currently displayed paths, the paths in the Offline(C), Offline(E), and Online(E) statuses will be changed to the Online status. Is this OK? [OK/Cancel]	Details The paths that are not online among the currently displayed paths will be changed to the Online status. If you want to continue, click **OK**. If you do not want to proceed, click **Cancel**. Action If you want to execute the online processing, click **OK**. To cancel the online processing, click **Cancel**.
KAPL02019-I	The currently selected paths will be changed to the Offline(C) status. Is this OK? [OK/Cancel]	Details The currently selected paths will be changed to the Offline(C) status. If you want to continue, click **OK**. If you do not want to proceed, click **Cancel**. Action If you want to execute the offline processing, click **OK**. To cancel the offline processing, click **Cancel**.

Message ID	Message	Details and Actions
KAPL02020-I	If you are sure that there would be no problem when the path is placed in the Offline(C) status, click OK. Otherwise, click Cancel. [OK/Cancel]	Details This is confirmation to determine whether you want to change the selected path(s) to Offline(C) status. If you want to continue, click **OK**. If you do not want to proceed, click **Cancel**. Action If you want to execute the offline processing, click **OK**. To cancel the offline processing, click **Cancel**.
KAPL02021-I	*aa...aa* path(s) were successfully placed *bb...bb*. *cc...cc* path(s) could not be placed *bb...bb*.	Details The online/offline processing has completed. *aa...aa*: Number of paths successfully processed (decimal number) *bb...bb*: Online or Offline *cc...cc*: Number of failed paths (decimal number) Action For the path ID of the path for which the online/offline processing failed, see the operation log.
KAPL02022-W	A path that cannot be placed in the Online status has been detected. PathID = *aa...aa* Would you like to continue the Online processing? [OK/Cancel]:	Details While performing online processing of multiple paths, a path that cannot be changed to Online was detected. If you want to ignore the path and continue, click **OK**. To cancel the operation, click **Cancel**. *aa...aa*: Path ID (decimal number) Action If you want to continue online processing, click **OK**. To cancel online processing, click **Cancel**. For the paths for which online processing failed, correct the errors, and then re-execute online processing.
KAPL02023-W	A path that cannot be placed in the Offline(C) status has been detected. PathID = *aa...aa* Would you like to continue the Offline processing? [OK/Cancel]:	Details During offline processing of multiple paths, a path that cannot be changed to Offline(C) was detected. If you want to ignore the path and continue, click **OK**. To cancel the operation, click **Cancel**. *aa...aa*: Path ID (decimal number) Action If you want to continue the offline processing, click **OK**. To cancel the offline processing, click **Cancel**. For paths that cannot be processed, take the following actions. Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL02026-W	The target path of the *aa...aa* operation could not be found.	Details The target path of the operation could not be found. *aa...aa*: Operation ■ Online ■ Clear Data ■ CSV Output ■ Get Path Information ■ Refresh Action Click **Refresh** to update the view contents, check the path status, and then retry.
KAPL02027-E	The last Online path or Online(E) path to the LU cannot be placed in the Offline(C) status. PathID = *aa...aa*	Details The path specified in the offline processing cannot be placed Offline(C) because it is the last path of the LU. *aa...aa*: Path ID (decimal number) Action Click **Refresh** to update the view contents, check the path status, and then retry.
KAPL02028-W	You lack write permission for the *aa...aa*.	Details You lack write permissions for the specified CSV file. *aa...aa*: Output CSV File Name Action Check whether you have access permissions for the specified file and whether the specified file name is correct.

Message ID	Message	Details and Actions
KAPL02029-E	An error occurred during internal processing of the HDLM GUI. The *aa...aa* operation has been stopped. Details = *bb...bb*	Details During the GUI processing, an error which might not be caused by a user operation occurred. *aa...aa*: Internal Processing Name ■ Get Option Information ■ Set Option Information ■ Online ■ Offline ■ Get Path Information ■ Refresh ■ Clear Data ■ Get HDLM Manager Status ■ Get HDLM Driver Status ■ Get HDLM Alert Driver Status *bb...bb*: Issuing API Name ■ JHSPGetOption ■ JHSPSetOption ■ JHSPOnlinePath ■ JHSPOfflinePath ■ JHSPGetPathBy ■ JHSPClearStatistics ■ JHSPGetManagerStatus ■ JHSPGetDriverStatus ■ JHSPGetADriverStatus ■ JHSPGetClusterService Action Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL02032-E	The *aa...aa* operation cannot be executed because the amount of memory is insufficient.	Details There was not sufficient memory available for the HDLM GUI processing. *aa...aa*: Internal processing names ■ CSV Output ■ Online ■ Offline ■ Get Path Information ■ Refresh ■ Clear Data ■ Get Option Information ■ Set Option Information ■ Get HDLM Manager Status ■ Get HDLM Driver Status ■ Get HDLM Alert Driver Status Action Terminate unnecessary applications to increase the amount of free memory, or restart the host.
KAPL02033-E	An unexpected error occurred, and the *aa...aa* operation has been stopped.	Details An exception occurred during the HDLM GUI processing. *aa...aa*: Internal processing names ■ CSV Output ■ Get Path Information ■ Refresh ■ Online ■ Offline ■ Clear Data ■ Get Option Information ■ Set Option Information ■ Get HDLM Manager Status ■ Get HDLM Driver Status ■ Get HDLM Alert Driver Status Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL02040-E	The Offline(C) path cannot be placed Online. PathID = *aa...aa*	Details *aa...aa*: Path ID (decimal number) Action Remove the error in the path, and then retry.

Message ID	Message	Details and Actions
KAPL02041-W	The cluster support function is active, so the load balancing function is not supported.	Details The load balancing function cannot be enabled because MSCS is installed. Action The load balancing function is not supported in an environment where MSCS is installed. If you want to use the load balancing function, uninstall MSCS.
KAPL02042-E	An unexpected error occurred. The HDLM GUI cannot start.	Details An exception occurred when starting the HDLM GUI. Action Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.
KAPL02043-E	The target path of the *aa...aa* operation could not be found. PathID = *bb...bb*	Details The target path of the operation could not be found. *aa...aa*: Online or Offline *bb...bb*: The Path ID to which the operation was attempted (decimal number) Action Click **Refresh** to update the view contents, and then check the path status, and then retry.
KAPL02044-W	*aa...aa* exists already. Do you want to overwrite it? [OK/Cancel]	Details The existing file will be overwritten. To continue, click **OK**. Otherwise, click **Cancel**. *aa...aa*: File name Action To overwrite the existing file, click **OK**. Otherwise, click **Cancel**.
KAPL02052-W	The HDLM manager could not be connected.	Details The HDLM manager could not be accessed during the start processing of the HDLM GUI. *aa...aa*: Get Option Information or Set Option Information Action Execute the `view` operation of the HDLM command (`dlnkmgr`) to check whether the HDLM manager has started. If the HDLM manager has not started, start the HDLM manager and then restart HDLM GUI. For details on the `view` operation, see section 7.7.
KAPL02053-I	Would you like to terminate the HDLM GUI? [OK/Cancel]	Action If you want to terminate the HDLM GUI, click **OK**. If you do not want to terminate the HDLM GUI, click **Cancel**.

Message ID	Message	Details and Actions
KAPL02054-I	*aa...aa* path(s) were successfully placed Offline(C). The Offline request of *bb...bb* path(s) were registered. *cc...cc* path(s) could not be placed Offline(C).	Details Indicates the number of the processed paths when the offline request was registered during the Reserve processing. *aa...aa*: The number of paths that succeeded in the offline processing (decimal number) *bb...bb*: The number of paths for which the offline request was registered (decimal number) *cc...cc*: The number of paths failed in the offline processing (decimal number) Action For the Path ID(s) of the failed path(s), see the operation log. Click **Refresh** if you want to check the registered path(s) in a batch job.
KAPL02055-I	The target path(s) are already *aa...aa*.	Details The specified paths are already Online/Offline(C), resulting from the online/offline processing. *aa...aa*: Online or Offline(C) Action Click **Refresh** to check the status of the path.
KAPL02058-E	The configuration does not support the simultaneous use of the load balancing and cluster support functions.	Details If a storage system for which persistent reserve is not supported exists among the HDLM-managed storage systems, the load balancing function cannot be used in the cluster environment. Action Make sure that all HDLM-managed storage systems support persistent reserve. Contact your storage system vendor or maintenance company to check whether the storage systems you are using support persistent reserve.
KAPL02061-W	The getting PathInformation has been stopped because the path configuration was changed during HDLM GUI startup processing.	Details The path information could not be acquired because the configuration of paths was changed during HDLM GUI startup processing. Action Click **Refresh** after you confirm the reconfiguration of the path is not done.
KAPL02062-E	The Refresh operation has been stopped because the configuration of paths was changed during the processing of the Refresh operation.	Details The information of the path could not be acquired because the configuration of paths was changed during the processing of the Refresh operation. Action Click **Refresh** after you confirm the reconfiguration of the path is not done.

Message ID	Message	Details and Actions
KAPL02063-W	The version number cannot be displayed.	Details The version number couldn't be acquired because it failed in reading of a parameter file to start HDLM GUI. Action The version number cannot be displayed, but the operation of HDLM GUI can execute. If you want to display the version number, install the HDLM again.
KAPL02064-W	The error monitoring interval and the number of times that the error is to occur conflict with the automatic failback checking interval.	Details An intermittent error cannot be detected by using the values specified for the following: the checking interval for automatic failback, the error monitoring interval, and the number of times the error is to occur. Action Set the intermittent error monitoring interval to a value that is equal to or more than (*automatic-failback-checking-interval* x *number-of-times-error-is-to-occur-for-intermittent-error-monitoring*).
KAPL02065-W	The getting PathInformation has been stopped because the configuration of paths was changed during the processing of the getting PathInformation.	Details The path information could not be get because the configuration of the path was changed when getting the latest path information after the Offline, Online, or Clear Data. Action Click **Refresh** after you confirm the reconfiguration of the path is not done.
KAPL02076-W	An attempt to acquire the HDLM version information failed. Details = *aa...aa*	Details The HDLM version information could not be acquired correctly. *aa...aa*: Code showing reason for error Action Re-execute. If the same error occurs even after removing the reservation, execute the `DLMgetras` utility for collecting HDLM error information to collect the error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.
KAPL02077-W	An attempt to acquire the Service Pack version information failed. Details = *aa...aa*	Details *aa...aa*: Code showing reason for error Action Re-execute. If the same error occurs even after removing the reservation, execute the `DLMgetras` utility for collecting HDLM error information to collect the error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

Message ID	Message	Details and Actions
KAPL02080-W	All the current trace files will be deleted. Is this OK? [OK/Cancel]	Details If you set a value less than the current value of the trace file size or number of trace files, all the current trace files will be deleted. To continue the operation, click **OK**. To cancel the operation, click **Cancel**. Action If you want to execute the operation, click **OK**. To cancel the operation, click **Cancel**.
KAPL02083-I	HDLM GUI is started by the user-specified JRE. *aa...aa*, *bb...bb*	Details *aa...aa*: The JRE version by user-specified (character string) *bb...bb*: The JRE vendor by user-specified (character string) Action None.
KAPL02084-E	An error occurred in HDLM GUI startup processing. HDLM GUI cannot start. Details = *aa...aa bb...bb cc...cc*	Details *aa...aa*: Executed Function name (character string) *bb...bb*: Return value of function (decimal number) *cc...cc*: Information that shows failure part (character string) Action Re-execute. If the same error occurs even after removing the reservation, execute the DLMgetras utility to collect the error information, and then contact your HDLM vendor or maintenance company if there is a maintena.
KAPL02087-I	"Configuration View" is not supported for this storage system model. Please use the "Path List View" instead. Storage = *aa...aa*	Details "Configuration View" cannot be displayed for the selected storage subsystem because the HDLM GUI does not support the configuration figure display for the selected storage subsystem. *aa...aa*: Name of Storage Subsystem Action Please use the "Path List View".
KAPL02200-I	GUI information - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: Trace information (character string) Action None.

9.4 HDLM API Messages

Message ID	Message	Details and Actions
KAPL03001-I	HDLM API information - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: Trace information Action None.
KAPL03002-W	HDLM API Warning - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: API trace information Action Refer to the contents of the warning.
KAPL03003-E	HDLM API Error information - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: API trace error information Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL03004-C	A critical error occurred in the HDLM API. (*aa...aa*)	Details This information is required for determining the cause of the problem (if any). *aa...aa*: API trace error information Action For details on the DLMgetras utility, see section 8.2.
KAPL03006-E	An access to the HDLM driver causes an error. (*aa...aa*)	Details This information is required for determining the cause of the problem (if any). *aa...aa*: API trace error information Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL03007-E	An error occurred during communication with the HDLM manager. (*aa...aa*)	Details This information is required for determining the cause of the problem (if any). *aa...aa*: API trace error information Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL03008-E	An error occurred during log input to the HDLM alert driver. (*aa...aa*)	Details This information is required for determining the cause of the problem (if any). *aa...aa*: API trace error information Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM For details on the DLMgetras utility, see section 8.2.
KAPL03999-E	An unexpected error occurred.	Details A conflict occurred in the versions of the modules that HDLM uses internally. Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.

9.5 HDLM Manager Messages

Message ID	Message	Details and Actions
KAPL04001-I	HDLM manager started.	Action None.
KAPL04002-E	Could not start the HDLM manager.	Details HDLM manager failed to start because the environment is incorrect for the manager to run properly. Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL04003-E	The startup parameter is invalid.	Details The parameter held internally by the HDLM manager is incorrect. Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL04004-I	HDLM manager will now terminate.	Action None.
KAPL04005-E	Cannot connect the service control manager.	Details HDLM manager cannot start normally (unable to connect the service control manager). Action The HDLM manager starts as a service. To start HDLM from the command line, use the net start DLMManager command.
KAPL04006-E	Cannot register the service control handler function. Return value = *aa...aa*	Details HDLM manager cannot start normally (unable to register the service control handler function). *aa...aa*: operating system error code Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL04007-E	Cannot register the service status. Return value = *aa...aa*	Details HDLM manager cannot start normally (unable to register the service status). *aa...aa*: operating system error code Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

Message ID	Message	Details and Actions
KAPL04008-E	Cannot open the option definition file (*aa...aa*).	Details HDLM manager cannot start normally (unable to open the option definition file). *aa...aa*: Option definition file name Action Check whether another program is using the file (or has opened the file with Notepad), or whether the file has been deleted inadvertently.
KAPL04009-E	The option definition is invalid.	Details HDLM manager cannot start normally (some of the definition in the option definition file is invalid). Action If the KAPL04033-W message is output after this message, execute `dlnkmgr view -sys -sfunc` and check the option settings. For options with setting values that have returned to default values, use the `dlnkmgr set` operation to reset the values. If the KAPL04033-W message is not output, restart HDLM Manager. If the same error occurs, re-install HDLM. For details on the `view` operation, see section 7.7. For details on the `set` operation, see section 7.6.
KAPL04010-E	Could not open the error log file.	Details HDLM manager cannot start normally (unable to open the error log file). Action Check whether another program is using the error log file (or has opened the file with Notepad), or whether the error log file has been deleted inadvertently.
KAPL04011-E	Could not output the error log file.	Details The log information could not be output to the error log file. Action Check that the disk has sufficient free space.
KAPL04012-E	Could not create a communication pipe. RC = *aa...aa*	Details HDLM manager cannot start normally (unable to create a pipe file to be used in communication with HDLM commands). *aa...aa*: operating system error code (decimal number) Action Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL04013-E	Input is impossible via the communication pipe. RC = *aa...aa*	Details Data could not be read from the pipe file during the communication with the HDLM command. *aa...aa*: operating system error code (decimal number) Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL04014-E	Output is impossible via the communication pipe. RC = *aa...aa*	Details Data could not be written to the pipe file during the communication with the HDLM command. *aa...aa*: operating system error code (decimal number) Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL04019-E	Could not collect the error information. RC = *aa...aa*	Details An attempt to read the log information from the alert driver failed. *aa...aa*: API return code (decimal number) Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL04021-I	HDLM manager information - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: HDLM manager trace information Action None.
KAPL04022-W	HDLM manager warning information - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: HDLM manager trace warning information Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL04023-E	HDLM manager error information - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: HDLM manager trace error information Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL04024-C	A critical error occurred in the HDLM manager. (*aa...aa*)	Details This information is required for determining the cause of the problem (if any). *aa...aa*: HDLM manager trace error information Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL04025-C	A memory shortage occurred in the HDLM manager.	Details Sufficient memory to process the HDLM manager could not be obtained. Action To increase the amount of free memory, terminate unnecessary applications or restart the host.
KAPL04026-I	The temporary license is valid. The license expires in *aa...aa* days on (*bb...bb*).	Details *aa...aa*: Number of remaining valid days *bb...bb:* Expiration day, the year of grace (4 numeric characters)/Month (01-12)/Day (01-31) Action Install the permanent license by the expiration day.
KAPL04027-I	The emergency license is valid. The license expires in *aa...aa* days on (*bb...bb*).	Details *aa...aa*: Number of remaining valid days *bb...bb:* Expiration day, the year of grace (4 numeric characters)/Month (01-12)/Day (01-31) Action Install the emergency license by the expiration day.
KAPL04028-E	The temporary license expired.	Action Install the permanent license.
KAPL04029-E	The emergency license expired.	Action Install the permanent license.
KAPL04030-E	The temporary license has already expired.	Action Install the permanent license.

Message ID	Message	Details and Actions
KAPL04031-E	The emergency license has already expired.	Action Install the permanent license.
KAPL04032-C	A fatal error occurred in HDLM. The system environment is invalid	Details A part of the HDLM configuration file is missing. Action Re-install HDLM.
KAPL04033-W	The option definition file was re-created.	Details An option definition file was re-created using the default values. The specified values are set when some of the options have been read. Action As for the options other than the defaults, use the `dlnkmgr set` operation to set the options again. For details on the `set` operation, see section 7.6.
KAPL04034-E	An attempt to create the option definition file has failed.	Details An attempt to re-create an option definition file using the default values has failed. Action Remove unnecessary files to secure free space on the file system, or check the write permissions for the directory and file.
KAPL04035-I	The path health check will now start. Total number of paths = *aa...aa*	Details *aa...aa*: Total number of paths Action None.
KAPL04036-I	The path health check for the path *aa...aa* was executed. Number of error paths = *bb...bb*	Details *aa...aa*: Number of paths targeted for the path health check. *bb...bb*: Number of error paths by the path health check. Action None.
KAPL04037-I	The path health check completed normally. Path ID = *aa...aa*	Details There were no error paths as a result of executing the path health check. *aa...aa*: The path ID for executing the path health check. Action None.
KAPL04042-I	HDLM SNMP TRAP information - *aa...aa*	Details There were no error paths as a result of executing the path health check. *aa...aa*: Start or Stop. Action None.

Message ID	Message	Details and Actions
KAPL04045-I	HDLM SNMP TRAP was sent. Trap ID = *aa...aa*, IP Address = *bb...bb*, Port Number= *cc...cc*, Community = *dd...dd*, Trap Data = *ee..ee*	Details *aa...aa*: Trap ID *bb...bb*: Destination IP address of the trap *cc...cc*: Destination port number of the trap *dd...dd*: Community Name given to the trap *ee...ee*: Send data Action None.

9.6 HDLM Driver (Filter Component) Messages

Message ID	Message	Details and Actions
KAPL05001-I	DriverEntry() started.	Details The initialization function was executed (started). Action None.
KAPL05002-I	DriverEntry() completed normally.	Details The initialization function completed successfully. Action None.
KAPL05003-I	The HDLM driver (filter component) was successfully attached to Disk (*aa...aa*), Partition (*bb...bb*).	Details The device object of the HDLM driver (filter component) was added to the device stack corresponding to Disk (*aa...aa*: Disk sequence number) and Partition (*bb...bb*: Partition sequence number that is fixed to 0). Action None.
KAPL05004-I	The filtering function (*aa...aa*) for the HDLM driver (filter component) was initialized successfully.	Details The HDLM driver (filter component) was successfully initialized for each device object. *aa...aa*: Device object address (hexadecimal number) Action None.
KAPL05005-I	The control function (*aa...aa*) for the HDLM driver (filter component) was initialized successfully.	Details The HDLM driver (filter component) was successfully initialized for each device object. *aa...aa*: Device object address (hexadecimal number) Action None.
KAPL05008-E	Could not allocate memory. (*aa...aa*:*bb...bb*)	Details The operating system memory allocation function or the function that allocates memory of the specified size as a side effect could not be executed. (*aa...aa*: Information indicating the number of program lines (hexadecimal number), *bb...bb*: Memory capture size (hexadecimal number)) Action Check whether the HDLM driver has started normally. If it has not started or contains an error, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL05010-E	Could not initialize the HDLM driver (filter component). (*aa...aa*:*bb...bb*)	Details The HDLM driver (filter component) could not be initialized for each device object. *aa...aa* and *bb...bb*: Device object address (*aa...aa* and *bb...bb*: Fixed to 0) Action Check whether the HDLM driver has started normally. If it has not started or contains an error, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code.
KAPL05011-E	Could not attach the HDLM driver (filter component) to Disk (*aa...aa*), Partition (*bb...bb*). (*cc...cc*:*dd...dd*)	Details The path corresponding to Disk (*aa...aa*: Disk sequence number (decimal number)) and Partition (*bb...bb*: Partition number (decimal number)) could not be registered in the core logic *cc...cc*: Error code (hexadecimal number) *dd...dd*: Filter driver management table address (hexadecimal number) Action Check whether the HDLM driver has started normally. If it has not started or contains an error, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code.
KAPL05012-I	The device (*aa...aa*) for Disk (*bb...bb*), Partition (*cc...cc*) is selected for a mounted drive.	Details The device object corresponding to Disk (*bb...bb*: Disk sequence number (decimal number)), Partition (*cc...cc*: Partition sequence number (decimal number)), and (*aa...aa*: Device object address (hexadecimal number)) is the first path for the LU (including the non-HDLM target device). Action None.
KAPL05013-I	The device (*aa...aa*) for Disk (*bb...bb*), Partition (*cc...cc*) was removed from the mounted drive.	Details The device object corresponding to Disk (*bb...bb*: Disk sequence number (decimal number)), Partition (*cc...cc*: Partition sequence number (decimal number)), and (*aa...aa*: Device object address (hexadecimal number)) is the second or subsequent path for the LU. Action This is normal operation. If the target drive cannot be referenced, check the disk configuration.

Message ID	Message	Details and Actions
KAPL05014-I	The device object (*aa...aa*) was registered as the path (*bb...bb*).	Details The path (*bb...bb*: Core logic path identifier (hexadecimal number)) of the device object (*aa...aa*: Filter driver management table address (hexadecimal number)) was successfully registered in the core logic. Action None.
KAPL05018-W	The FO processing in the path (*aa...aa*) failed. (*bb...bb*:*cc...cc*)	Details There is no path where FO processing is to be performed. Path (*aa...aa*: Path ID of the path where I/O processing was performed for the first time (hexadecimal number)), (*bb...bb*: Failure code (hexadecimal number), *cc...cc*: Identification value for internal processing (0 or 1)) Action The I/O being processed is discarded. Check the status of the device path and take an appropriate action.
KAPL05031-W	Disk(*aa...aa*) is not a target disk system for HDLM.(*bb...bb*,*cc...cc*)	Details The disk (*aa...aa*: Partition sequence number (decimal number)) is not a CoreLogic management-target disk. (*bb...bb*: Degree of progress in disk recognition processing (hexadecimal number), *cc...cc*: Execution result of the disk confirmation command for disk recognition processing (hexadecimal number)) Action If this message is displayed for a disk that is not supported by HDLM, there is no problem. If this message is displayed for a disk that is supported by HDLM, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL05032-I	The path health checking for the path (*aa...aa*) completed normally. (*bb...bb*,*cc...cc*)	Details *aa...aa*: Path ID (hexadecimal number) *bb...bb*: Disk sequence number (decimal number) *cc...cc*: Degree of progress in health checking (hexadecimal number) Action None.

Message ID	Message	Details and Actions
KAPL05033-W	The path health checking for the path (*aa...aa*) failed.(*bb...bb*,*cc...cc*,*dd...dd*)	Details *aa...aa*: Path ID (hexadecimal number) *bb...bb*: Disk sequence number (decimal number) *cc...cc*: Degree of progress in health checking (hexadecimal number) *dd...dd*: Execution result of health checking (hexadecimal number) Action Check the path for which the path health checking failed. If this message is displayed for an unexpected path, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL05034-I	Disk(*aa...aa*) is a target disk system for HDLM.(*bb...bb*,*cc...cc*)	Details The disk is a CoreLogic management-target disk. *aa...aa*: Partition sequence number (decimal number) *bb...bb*: Degree of progress in disk recognition processing (hexadecimal number) *cc...cc*: Execution result of the disk confirmation command for disk recognition processing (hexadecimal number) Action None.
KAPL05035-I	The HDLM driver (filter component (*aa...aa*)) was successfully attached to the device object (*bb...bb*).	Details The physical device object was successfully attached to the device stack. *bb...bb*: Device object address (decimal number) Action None.
KAPL05036-E	Failed to attach the HDLM driver (filter component (*aa...aa*)) to the device object (*bb...bb*).	Details The physical device object could not be added to the device stack. *bb...bb*: Device object address (decimal number) Action Check whether the HDLM driver has started normally. If it has not started or contains an error, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code.

Message ID	Message	Details and Actions
KAPL05301-E	A path has been removed.	Details When the LU deletion functionality is available, the path information is output to the event log. The removed path information is displayed in the event viewer with the following format: PathID PathName DskName iLU ChaPort When a path is added to an LU, this message might appear. Note that this message is output by Windows activities, and not by an error. Action Make sure that the path is correctly connected to the LU, and then recover the path. If failed to recover the path, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL05819-I	Data for maintenance: *aa...aa bb...bb cc...cc dd...dd*.	Details The filter driver outputs this message for maintenance. *aa...aa*: HDLM Device minor number (decimal number) *bb...bb*: Message output location information (decimal number) *cc...cc*: Detailed information 1 (decimal number) *dd...dd*: Detailed information 2 (decimal number) Action None.

9.7 HDLM Driver (Core Logic Component) Messages

Message ID	Message	Details and Actions
KAPL07819-I	Data for maintenance: *aa...aa bb...bb cc...cc dd...dd*.	Details This message is generated by the core logic for maintenance. *aa...aa*: Detailed information 1 (decimal number) *bb...bb*: Internal function number of the core logic (decimal number) *cc...cc*: Detailed information 2 (decimal number) *dd...dd*: Detailed information 3 (decimal number) Action None.
KAPL07820-E	The configuration does not support the simultaneous use of the load balancing and cluster support functions.	Details Because this storage system does not support persistent reservation, the load balancing function cannot be used in the cluster environment. Action Update all the HDLM target storage systems to a version that supports Persistent-Group-Reserve. Contact your HDLM vendor or, if you have a maintenance contract for HDLM, your maintenance company, to confirm whether storage systems support Persistent-Group-Reserve.
KAPL07821-I	An LU that cannot use the load balancing function in a cluster configuration is connected.	Details An LU of a storage system that cannot use the persistent reservation is connected. In a cluster configuration, the load balancing function cannot be used for an LU of a storage system that cannot use the persistent reservation. HDLM regards the EMC DMX series, EMC CX series, and HP EVA series as a storage system that does not support the persistent reservation. Action None.
KAPL07822-W	An LU connected to PathID (*aa...aa*) cannot use the load balancing function in a cluster configuration.	Details An LU connected to the PathID shown as *aa...aa* is an LU of a storage system that cannot use the persistent reservation. In a cluster configuration, the load balancing function cannot be used for this LU. *aa...aa*: Path ID (same as PathID of view -path) Action None.

Message ID	Message	Details and Actions
KAPL07823-W	An LU connected to PathID (*aa...aa*) can also use the load balancing function in a cluster configuration.	Details An LU connected to the PathID shown as *aa...aa* is an LU of a storage system that can use the persistent reservation. In a cluster configuration, the load balancing function can also be used for this LU. *aa...aa*: Path ID (same as PathID of view -path) Action None.

9.8 HDLM Management Target Messages

Message ID	Message	Details and Actions
KAPL08019-E	The path (*aa...aa*) detected an error (*bb...bb*). (*cc...cc*)	Details An error occurred in the path because of a condition such as a disconnection. *aa...aa*: Path identifier (hexadecimal number) *bb...bb*: Error code (hexadecimal number) ■ When a path error was detected by path health checking or an `online` operation 0x000F0000(Fixed) is displayed. ■ When the path error was detected through an I/O error The OS error code is displayed. *cc...cc*: Address of the filter driver in which the error occurred (character string) Action Check the path in which the error was detected.
KAPL08022-E	A path error occurred. ErrorCode = *aa...aa*, PathID = *bb...bb*, PathName = *cc...cc.dd...dd.ee...ee.ff...ff*, DNum = *gg...gg*, HDevName = *hh...hh*	Details A physical or logical error occurred in the path. *aa...aa*: operating system error code (hexadecimal number) ■ When a path error was detected by path health checking or an `online` operation 0x000F0000(Fixed) is displayed. ■ When the path error was detected through an I/O error The OS error code is displayed. *bb...bb*: Path ID (same as PathID of `view -path`) (decimal number) *cc...cc*: Host port number (same as PathName of `view -path`) (hexadecimal number) *dd...dd*: Bus number (hexadecimal number) *ee...ee*: Target ID (hexadecimal number) *ff...ff*: HLU number (same as PathName of `view -path`) (hexadecimal number) *gg...gg*: Dev number (same as DNum of `view -path`) (decimal number) *hh...hh*: Host device name Action The path may have a problem. For details on the action to be taken, see section 5.3 and switch the path shown in the message to Online.

Message ID	Message	Details and Actions
KAPL08023-I	A path was recovered. PathID = *aa...aa*, PathName = *bb...bb.cc...cc.dd...dd.ee...ee*, DNum = *ff...ff*, HDevName = *gg...gg*	Details The path was recovered from the error. *aa...aa*: Path ID (same as PathID of `view –path`) (decimal number) *bb...bb*: Host port number (same as PathName of `view –path`) (hexadecimal number) *cc...cc*: Bus number (same as PathName of `view –path`) (hexadecimal number) *dd...dd*: Target ID (same as PathName of `view –path`) (hexadecimal number) *ee...ee*: HLU number (same as PathName of `view –path`) (hexadecimal number) *ff...ff*: Device number (same as DNum of `view –path`) *gg...gg*: Host Dev name(same as HDevName of `view –path`) Action None.
KAPL08024-I	A path was recovered. PathID = *aa...aa*,PathName = *bb...bb.cc...cc.dd...dd.ee...ee*,Dnum = *ff...ff*,HDevName =*gg...gg*,LDev = *hh...hh*	Details The path was recovered from the error. *aa...aa*: Path ID (same as PathID of view -path) (decimal number) *bb...bb*: Port number (hexadecimal number) *cc...cc*: Path number (hexadecimal number) *dd...dd*: Target ID (hexadecimal number) *ee...ee*: HLU number (hexadecimal number) (same as PathName of view -path) *ff...ff*: Dev number (same as Dnum of view -path) (decimal number) *gg...gg*: Host device name *hh...hh*: The model name, serial number, and iLU number for the storage system, separated by periods (same as LDEV displayed in the HDLM GUI) Action None.
KAPL08025-I	A path was recovered. PathID = *aa...aa*.	Details The auto recover function recovered a path from an error. *aa...aa*: Path ID (same as PathID of view -path) (decimal number) Action None.

Message ID	Message	Details and Actions
KAPL08026-E	An error occurred on all the paths of the LU. PathID = *aa...aa*	Details An error occurred in the last path of one LU because of a condition such as a disconnection. *aa...aa*: Path ID (same as PathID of `view -path`) (decimal number) Action Find the KAPL05301-E message in the event log to identify the storage sub system the error was detected and recover from the error.
KAPL08027-E	A path was excluded from the items subject to automatic failback. PathID = *aa...aa*	Details A path was excluded from the items subject to automatic failback because the system judged that an intermittent error was occurring in that path. *aa...aa*: Path ID (same as PathID of `view -path`) (decimal number) Action An intermittent error was occurring. The path may have a problem. For details on the action to be taken, see section 5.3 and switch the path shown in the message to Online.

9.9 HDLM Installation Program Messages

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09002-E	The disk does not have sufficient free space.	Action Change the installation destination or delete unnecessary files to increase the amount of free space, and then retry.
KAPL09003-E	Cannot install in this system.	Details HDLM cannot be installed on this system. Action Install HDLM in a Windows 2000 Server or Windows Server 2003 system.
KAPL09004-I	Installation has finished. Restart the system.	Action To immediately restart the system, select the check box for [Yes. I want to restart my computer now]. If you do not want to immediately restart the system, select the checkbox for [No. I will restart my computer later].
KAPL09005-E	Could not stop the HDLM manager.	Details An attempt to stop the HDLM manager service has failed. Action Stop the HDLM manager manually, and then re-execute the installation program or the uninstallation program.
KAPL09006-E	Could not install HDLM.	Action If installation was interrupted, incomplete files and folders may remain. Delete such files and folders.
KAPL09007-W	HDLM version *aa...aa* is installed. Do you want to overwrite it?	Details Confirm whether you want to overwrite the existing installation. *aa...aa*: Version number (character string) Action Choose **OK** to install HDLM by overwriting the older version.
KAPL09008-W	The license code is invalid.	Action Check the license code, and then re-enter it.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09009-E	The license code is invalid. The HDLM installation program will now terminate.	Details The HDLM installation program is terminating because multiple attempts to enter the license code failed. Action Check the license code, and then re-execute the installation program.
KAPL09010-E	You cannot install onto storage media that is not a built-in disk.	Action Install HDLM onto a built-in disk.
KAPL09014-E	The operating system must be restarted before you install HDLM. The HDLM installation program will now terminate.	Action Restart the operating system before HDLM is installed.
KAPL09015-E	HDLM cannot be installed. A newer version of HDLM is already installed.	Action Uninstall HDLM, and then restart the installation program.
KAPL09016-E	Because HDLM has been installed in another system, HDLM cannot be installed in this system.	Details HDLM cannot be installed on this system because it has already been installed from another system. Action Uninstall the HDLM that has been installed for another operating system in the same drive, and then restart the installation program.
KAPL09019-E	An attempt to cancel the registration of the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed.	Details An attempt to cancel registration of the PP name of HNTRLib2 has failed. Action Manually cancel the registration of the bundle PP name and uninstall Hitachi Network Objectplaza Trace Library 2. If the attempt to cancel the registration of the bundle PP name and to uninstall Hitachi Network Objectplaza Trace Library 2 fails again, contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.
KAPL09020-E	An attempt to uninstall Hitachi Network Objectplaza Trace Library 2 failed.	Details An attempt to uninstall HNTRLib2 has failed. Action Manually uninstall Hitachi Network Objectplaza Trace Library 2. If the attempt to uninstall Hitachi Network Objectplaza Trace Library 2 fails again, contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09021-E	An attempt to register the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed.	Details An attempt to register the PP name of HNTRLib 2 has failed. Action Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.
KAPL09026-I	Hitachi Network Objectplaza Trace Library 2 wasn't uninstalled because it was being used for other products.	Details HNTRLib2 was not uninstalled because it was being used for other PP. Action None.
KAPL09034-E	An Internal error occurred in the HDLM Installer. Code = *aa...aa bb...bb*	Details An error whose cause does not seem to be a user operation occurred during installation of HDLM. *aa...aa*: Error number (decimal number) *bb...bb*: Detailed information (decimal number) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.
KAPL09071-E	The specified installation folder is read-only. Specify a different folder.	Details Since the install folder you specified is read-only, you cannot install. Action Specify an installation folder that is not read-only.
KAPL09076-I	The permanent license was installed.	Action None.
KAPL09077-I	The temporary license was installed. The license expires on *aa...aa*.	Details The temporary license was installed. *aa...aa*: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31) Action Install the permanent license by the expiration day.
KAPL09078-I	The emergency license was installed. The license expires on *aa...aa*.	Details The emergency license was installed. *aa...aa*: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31) Action Install the permanent license by the expiration day.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09079-I	The permanent license has been installed.	Action None.
KAPL09080-I	The temporary license has been installed. The license expires on *aa...aa*.	Details *aa...aa*: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31) Action Install the permanent license by the expiration day.
KAPL09081-I	The emergency license has been installed. The license expires on *aa...aa*.	Details *aa...aa*: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31) Action Install the permanent license by the expiration day.
KAPL09082-W	The temporary license expired.	Action Enter the permanent license key.
KAPL09083-W	The emergency license expired.	Action Enter the permanent license key.
KAPL09084-W	The temporary license cannot be installed.	Details The temporary license expired. Action Enter the permanent license key.
KAPL09085-W	The emergency license cannot be installed.	Details The emergency license cannot be installed on the emergency license. Action Enter the permanent license key.
KAPL09086-W	The entered license key is invalid.	Action Enter a valid license key.
KAPL09087-E	The entered license key is invalid. Renewal of the license key will now stop.	Details The renewal of the license key will be aborted because an invalid license key was entered three times. Action Obtain a valid license key, and then retry.
KAPL09088-E	The entered license key is invalid. The HDLM installation will now terminate.	Action Retry installation.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09089-W	License information cannot be acquired.	Details License information cannot be acquired from the already installed HDLM environment. Action When the message that prompts you to install the license is displayed, install the license.
KAPL09090-W	This operation will now be continued without updating the license.	Details This operation will be continued without updating the license. Action Install the permanent license later.
KAPL09091-E	A fatal error occurred in HDLM. The system environment is invalid.	Details A part of the HDLM configuration file is missing. Action Re-install HDLM.
KAPL09093-I	*aa...aa* will be installed. Is this OK?	Details *aa...aa*: Version of the SP to be installed. Action To execute installation, enter y. To stop installation, enter n.
KAPL09112-E	The license key file is invalid. File name = *aa...aa*	Details The format of the license key file is invalid. *aa...aa*: *Windows-installation-destination-drive-name*:\hdlm_license or *the file that the user specified* Action Store the license key file directly under the *Windows installation-destination-drive*.
KAPL09113-E	There is no installable license key in the license key file. File name = *aa...aa*	Details There is no HDLM-installable license key in the license key file. *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license or *the-file-that-the-user-specified* Action In the license key file, store a license key that is available to install HDLM, and then re-install HDLM.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09114-I	There is no license key file. File name = *aa...aa*	Details There is no license key file in the designated directory. *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license or *the file that the user specified* Action When the message that prompts you to enter the license key is displayed, enter the license key. Alternatively, cancel the installation, save the correct license key file in the designated directory, and then re-execute installation.
KAPL09115-W	An attempt to delete the license key file has failed. File name = *aa...aa*	Details An attempt to delete the license key file has failed. *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license or *the file that the user specified* Action If a license key file exists, delete it.
KAPL09118-W	The license key file is invalid. File name = *aa...aa*	Details The format of the license key file is invalid. *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license or *the file that the user specified* Action Store a correct license key file in the designated directory, and then re-execute.
KAPL09119-W	There is no installable license key in the license key file. File name = *aa...aa*	Details There is no HDLM-installable license key in the license key file. *aa...aa*: *Windows-installation-destination-drive-name*\hdlm_license or *the file that the user specified* Action Make sure that the license key file is correct, and then re-execute.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09127-W	The MPIO driver has already been installed in this system. Driver *aa...aa* has already been installed. The file version is *bb...bb*. Driver *aa...aa* has already been installed. The file version could not be acquired. If installation continues, *dd...dd* of file version *cc...cc* will be overwritten.	Details The displayed message differs depending on the file. If the file version was obtained, the following message is displayed: Driver *aa...aa* has already been installed. The file version is *bb...bb*. The following message is not displayed: Driver *aa...aa* has already been installed. The file version could not be acquired. If the file version could not be obtained, the message Driver *aa...aa* has already been installed. The file version could not be acquired is displayed. The message Driver *aa...aa* has already been installed. The file version is *bb...bb* is not displayed. *aa...aa*: File name (mpio.sys, mpspfltr.sys, or mpdev.sys) *bb...bb*: Version of the installed file (mpio.sys, mpspfltr.sys, or mpdev.sys) *cc...cc*: Version of the file (mpio.sys, mpspfltr.sys, or mpdev.sys) to be installed *dd...dd*: File name (mpio.sys, mpspfltr.sys, or mpdev.sys) Action To continue processing, click **Next**. To cancel processing, click **Cancel**.
KAPL09128-W	The entered PRSV key is invalid.	Details An invalid PRSV key has been entered. Action Enter a valid PRSV key.
KAPL09129-E	The version upgrade from *aa...aa* to *bb...bb* cannot be executed.	Details If a version earlier than HDLM 5.5 has already been installed, version HDLM 5.5 or later cannot be installed. *aa...aa*: Version of the installed HDLM *bb...bb*: Version of the HDLM to be installed Action Refer to the manual 3.6.4.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09131-W	An attempt to register the PRSV key has failed.	Details An attempt to register the PRSV key has failed. Action After installation finishes, without rebooting execute the `dlmprsvkey` utility for registering HDLM persistent reservation key to register the PRSV key. For details on the `dlmprsvkey` utility, see section 8.4.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09134-E	The HDLM path cannot be added to the Path environment variable.	Details The HDLM path could not be added to the Path environment variable. Action After you add a path by using HDLM, edit the `Path` environment variable making sure that it stays within the following length: In Windows Server 2003 SP1 or Windows Server 2003 R2 (no service pack), if the `Path` environment variable was rounded down to 1,024 bytes, and the Microsoft patch program has been applied to solve this problem: 2,047 bytes In Windows Server 2003 SP1 or Windows Server 2003 R2 (no service pack), if the `Path` environment variable was rounded down to 1,024 bytes, but the Microsoft patch program has not been applied to solve this problem: 1,023 bytes When the HDLM default path is specified, the following three file paths are added to the environment variable. Windows 2000 Server and Windows Server 2003 (IA32) (213 bytes including the added ";") ■ `C:\Program Files\HDVM\HBaseAgent\bin` ■ `C:\Program Files\HDVM\HBaseAgent\util\bin` ■ `C:\Program Files\HITACHI\DynamicLinkManager\bin` ■ `C:\Program Files\HITACHI\DynamicLinkManager\lib` ■ `C:\Program Files\Common Files\Hitachi` Windows Server 2003 (IPF and x64) (243 bytes including the added ";") ■ `C:\Program Files (x86)\HDVM\HBaseAgent\bin` ■ `C:\Program Files (x86)\HDVM\HBaseAgent\util\bin` ■ `C:\Program Files (x86)\HITACHI\DynamicLink Manager\bin` ■ `C:\Program Files (x86)\HITACHI\DynamicLinkManager\lib` ■ `C:\Program Files (x86)\Common Files\Hitachi` ■ However, if Hntrlib2 has already been installed, the following file paths are not added: Windows 2000 Server and Windows Server 2003 (IA32) ■ `C:\Program Files\Common Files\Hitachi` Windows Server 2003 (IPF and x64) ■ `C:\Program Files (x86)\Common`

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09135-E	One of the following was executed at the same time as an HDLM command set -lic operation: another set -lic operation, or an update of the license for an update installation.	Action Check the license by using the HDLM command's `view -sys -lic` operation. Then, if necessary, update the license by using the `set -lic` operation during or after installation. If the same error message is output, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. Do not perform the following operation: Execution of the HDLM command's `set -lic` operation simultaneously with a license update for an upgrade or re-installation of HDLM
KAPL09142-E	HDLM aa...aa cannot be performed. Wait a while, and then perform aa...aa again. Error Code = bb...bb	Details HDLM cannot be installed or uninstalled. aa...aa : "installation" or "uninstallation" bb...bb : Internal code (decimal number) Action Wait a while, and then perform the installation or uninstallation again. If this message is still displayed, execute the `hbsasrv stop -f` command, and then perform the installation or uninstallation again.
KAPL09144-E	An attempt to specify an MPIO setting failed.	Action After installing HDLM and restarting the OS, re-install HDLM.
KAPL09173-W	HDLM version aa...aa is installed. Do you want to overwrite it with version bb...bb?	Details aa...aa: Version number (character string) of the HDLM already installed bb...bb: Version number (character string) of the HDLM to be installed Action Choose **OK** button to install HDLM by overwriting the older version.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09174-E	HDLM cannot be installed because automatic name generation for files and folders (NTFS 8.3) is disabled.	Details HDLM cannot be installed if "8.3-format short names" is not created for "%CommonProgramFiles%\InstallShield\Engine\6\Intel 32". Action Carry out the following procedure: Set the following Windows registry value to 0: `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem\NtfsDisable8dot3NameCreation` Restart the host. Rename the Intel 32 folder using eight or fewer one-byte alpfanumeric characters. Re-install HDLM.
KAPL09179-I	Data for maintenance: *aa...aa bb... bb*	Details *aa...aa*: Message output location information (decimal number) *bb...bb*: Detailed information (character string) Action None.
KAPL09180-I	HDLM installation will now start.	Details The unattended installation of HDLM has started. Action None.
KAPL09181-I	The installation of HDLM version *aa...aa* completed normally.	Details The unattended installation of HDLM completed normally. *aa...aa*: Version number of the installed HDLM (character string). Action None.
KAPL09182-W	An attempt to install HDLM version *aa...aa* has failed.	Details The unattended installation of HDLM failed. *aa...aa*: Version number of the HDLM you tried to install (character string). Action Determine the cause of this error by referring to the previous warnings and error messages.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09183-I	HDLM version *aa...aa* is installed. This version will now be overwritten with version *bb...bb*.	Details *aa...aa*: Version number of the installed HDLM (character string). *bb...bb*: Version number of the HDLM you tried to install (character string). Action None.
KAPL09184-I	The PRSV key was registered. (PRSV key = *aa...aa*)	Details *aa...aa*: PRSV key (hexadecimal number) Action None.
KAPL09185-I	Restart the computer.	Details The installation of HDLM completed normally. Restart the computer before using HDLM. Action Restart the computer and make sure that HDLM is running correctly.
KAPL09186-I	The computer will now restart.	Details After HDLM is installed, the computer will restart because restart was specified in `installhdlm.ini`. Action After the computer restarts, make sure that HDLM is running correctly.
KAPL09187-W	No parameter is specified.	Details No parameter (the installation information settings file) is specified to the `installhdlm.exe`. Action Make sure that the parameters for `installhdlm.exe` are appropriate, and then try again.
KAPL09188-W	Too many parameters are specified.	Details More than two parameters are specified for `installhdlm.exe`. Action Make sure that the parameters for `installhdlm.exe` are appropriate, and then try again.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09189-W	The parameter contains an incorrect value. (Value = *aa...aa*)	Details Either `-f` or `-h` must be specified as the first parameter of `installhdlm.exe`. *aa...aa*: Invalid parameter (character string) Action Make sure that the parameters for `installhdlm.exe` are appropriate, and then try again.
KAPL09190-W	The installation information settings file is not specified.	Details The installation information settings file is not specified for the second parameter of `installhdlm.exe`. Action Make sure that the parameters for `installhdlm.exe` are appropriate, and then try again.
KAPL09191-W	The installation information settings file does not exist.	Details The installation information settings file specified for the second parameter does not exist. Action Make sure that the path name of the installation information settings file is appropriate, and the try again.
KAPL09192-W	An installation information settings file of an unsupported product version is specified. (hdlmversion = *aa...aa*)	Details The specified `installhdlm.ini` file is not supported by this version of HDLM. *aa...aa*: The HDLM version of the specified `installhdlm.ini` (character string). Action Specify the installation information settings file of this version or an earlier version of HDLM, and then try again.
KAPL09193-W	A definition in the installation information settings file is invalid. (*aa...aa* = *bb...bb*)	Details An invalid value is specified for a key. *aa...aa*: The key where the invalid value is specified (character string) *bb...bb*: The invalid value (character string) Action Correct the definition in the installation information settings file, and then try again.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09194-W	A folder or file specified in the installation information settings file does not exist. (*aa...aa* = *bb...bb*)	Details The folder or file specified for a key does not exist *aa...aa*: The key where the path name of a file or folder is specified (character string) *bb...bb*: The path name of the file or folder that does not exist (character string) Action Correct the definition in the installation information settings file, and then try again.
KAPL09195-W	The setup.exe file does not exist.	Details HDLM cannot be installed because the installation program (`setup.exe`) does not exist. Action Execute the `installhdlm.exe` on the installation CD-ROM.
KAPL09196-W	Some of the LUs managed by HDLM are not in a single path configuration.	Details Before an upgrade installation, reconfigure the system into a single-path configuration. Action Reconfigure the system into a single-path configuration, and then try again.
KAPL09197-W	The user terminated installhdlm.exe, but HDLM installation will continue.	Details `installhdlm.exe` was forcibly stopped by an action such as pressing **Ctrl** + **C**. The `installhdlm.exe` processing has ended, but HDLM installation will continue. Action Refer to `installhdlm.log` and make sure that the installation completed normally.
KAPL09198-E	An error occurred in I/O of the installation information settings file. Code = *aa...aa bb...bb*	Details An error whose cause does not seem to be a user operation occurred. in I/O of the installation information settings file. *aa...aa*: Error number (decimal number) *bb...bb*: Detailed information (decimal number) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.

Message ID	Message	Details and Actions
KAPL09001-E	There is no system management permission.	Details The current user does not have the administrator permission to install HDLM. Action Execute the program as a member of the Administrators group.
KAPL09501-E	HDLM is not installed on this system.	Details The SP cannot be applied because HDLM is not installed in this system. Action Check whether HDLM has been correctly installed.
KAPL09504-E	The language environments of HDLM and the Service Pack are different.	Details The Japanese SP was applied to the English edition of HDLM, or vice versa. Action Acquire the SP that has the same language as the installed HDLM, and then try again.
KAPL09505-E	*aa...aa* cannot be applied to the installed *bb...bb*.	Details *aa...aa*: the-HDLM-to-be-installed HDLM-version or the-SP-to-be-installed HDLM-version *bb...bb*: the-installed-HDLM HDLM-version or the-installed-SP HDLM-version Action An upgrade installation or re-installation cannot be performed on the already installed HDLM or SP. When installing a HDLM: Uninstall the installed HDLM or SP, and then perform installation. When installing a SP: Obtain, and then install, a SP or corrected version that can be applied to the installed HDLM.
KAPL09509-E	Service Pack *aa...aa* cannot be installed. The same version has already been installed.	Details The same version as that of SP to install is already installed. Installation of SP is stopped. *aa...aa*: version of the SP to install Action You do not have to install the SP. Keep using HDLM already installed.
KAPL09510-E	Service Pack *aa...aa* cannot be installed. A newer *bb...bb* version has already been installed.	Details A newer version of the SP is already installed. Installation of SP is stopped. *aa...aa*: The version of the SP to install *bb...bb*: The version of HDLM or the SP that has already been installed Action You do not have to install the SP. Keep using HDLM already installed.

9.10 Messages from the DLMgetras Utility for Collecting HDLM Error Information

Message ID	Message	Details and Actions
KAPL10001-W	No parameter has been specified.	Details No parameter (folder to which collected information is output) has been specified. Action Check the parameters of the DLMgetras utility for collecting HDLM error information, and then retry. For details on the DLMgetras utility, see section 8.2.
KAPL10002-W	Too many parameters have been specified.	Details Four or more parameters have been specified. Action Check the parameters of the DLMgetras utility for collecting HDLM error information, and then retry. For details on the DLMgetras utility, see section 8.2.
KAPL10003-W	The first parameter has not been set to a directory. Value = *aa...aa*	Details The first parameter must be set to a folder to which collected information is output. *aa...aa*: First parameter Action Check the parameters of the DLMgetras utility for collecting HDLM error information, and then retry. For details on the DLMgetras utility, see section 8.2.
KAPL10004-W	The parameter contains an incorrect value. Value = *aa...aa*	Details The first parameter must be a directory. *aa...aa*: Invalid parameter Action Check the parameters of the DLMgetras utility for collecting HDLM error information, and then retry. For details on the DLMgetras utility, see section 8.2.
KAPL10009-W	The specified directory already exists. Do you want to overwrite it? [y/n]:	Details The specified folder already exists. Enter y to overwrite it or n to cancel. Action The specified folder already exists. Enter y to overwrite the existing file. Enter n or press any other key to terminate the DLMgetras utility for collecting HDLM error information, without executing it. For details on the DLMgetras utility, see section 8.2.

Message ID	Message	Details and Actions
KAPL10012-W	The specified file or directory does not exist. Line = *aa...aa*, Value = *bb...bb*	Details The specified file or folder does not exist in the file for defining the information to be collected. *aa...aa*: Line number of the file for defining information to be collected (decimal number) *bb...bb*: Indicated contents in a line Action After the DLMgetras utility for collecting HDLM error information terminates, check the contents of the file for defining the information to be collected. This file is shown in the message. If the contents of the file are incorrect, correct them and then try to collect error information again. The DLMgetras utility will ignore the specified file or directory and continue processing. For details on the DLMgetras utility, see section 8.2.
KAPL10017-W	You lack privileges for executing the utility for collecting HDLM error information.	Details The DLMgetras utility for collecting HDLM error information must be executed by a user included in the administrator group. Action Re-execute as a user with administrator group.privileges. For details on the DLMgetras utility, see section 8.2.
KAPL10020-I	The file has been obtained successfully. File = *aa...aa*, Collection time = *bb...bb*(GMT:*bb...bb*)	Details The file to be collected has been obtained. *aa...aa*: Collected file name *bb...bb:* The year of grace/month/day hour:minute:second Action None.
KAPL10022-I	The utility for collecting HDLM error information completed normally.	Details Error information has been collected. Action None. For details on the DLMgetras utility, see section 8.2.
KAPL10030-I	A user terminated the utility for collecting HDLM error information.	Details Processing of the DLMgetras utility has been terminated because n was sent as a confirmation reply. Action None. For details on the DLMgetras utility, see section 8.2.
KAPL10031-W	The entered value is invalid. Continue operation ? [y/n]:	Details A value other than y or n has been entered for a [y/n] request. Enter y or n. Action Enter y or n.

Message ID	Message	Details and Actions
KAPL10032-W	The entered value is invalid. The utility for collecting HDLM error information stops.	Details Processing of the DLMgetras utility for collecting HDLM error information will terminate because an invalid response was sent three times to a request. Action Re-execute the DLMgetras utility. For details on the DLMgetras utility, see section 8.2.
KAPL10033-W	The file does not exist. Filename = *aa...aa*	Details The file subject to collection does not exist. *aa...aa*: File subject to collection Action This file is normally obtainable, so the environment might be invalid. Check the system configuration.
KAPL10034-E	The file could not be copied. Filename = *aa...aa*, Details = *bb...bb*	Details Execution of the cp command failed. *aa...aa*: File name you tried to copy *bb...bb*: cp output message Action An error occurred while the file to be collected was being copied. The user environment might have been unstable. Check the system configuration.
KAPL10041-I	Collection of *aa...aa* information will now start.	Details *aa...aa*: Log information to be collected Action None.
KAPL10042-I	Collection of *aa...aa* information will now finish.	Details *aa...aa*: Collected log information Action None.
KAPL10043-I	Error information is being collected. (*aa...aa*%)	Details *aa...aa*: Collected log information as a percentage of all information to be collected Action None.
KAPL10044-W	There is insufficient disk space.	Details DLMgetras utility for collecting HDLM error information execution will now stop because the available disk space has decreased to less than 50 MB. Action Re-execute in an environment that has at least 50 MB of free disk space.

Message ID	Message	Details and Actions
KAPL10045-W	A parameter is invalid.	Details The specified parameter is invalid. Action Make sure that the parameters for the DLMgetras utility for collecting HDLM error information are appropriate, and then try again.
KAPL10046-W	A parameter value is invalid.	Details The specified parameter is invalid. Action Make sure that the parameters for the DLMgetras utility for collecting HDLM error information are appropriate, and then try again.
KAPL10047-W	A necessary parameter value has not been specified. (parameter = *aa...aa*)	Details A mandatory parameter value has not been specified. *aa...aa*: Parameter name Action Make sure that the parameters for the DLMgetras utility for collecting HDLM error information are appropriate, and then try again.
KAPL10048-E	An error occurred in internal processing of the utility for collecting HDLM error information. Details = *aa...aa*, *bb...bb*	Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL10080-I	Data for maintenance: *aa...aa bb...bb cc...cc dd...dd*	Details *aa...aa*: Maintenance information *bb...bb*: Error number of the Windows API (hexadecimal number) *cc...cc* and *dd...dd*: Fixed to 0 (hexadecimal number) Action None
KAPL10081-I	Data for maintenance: *aa...aa bb...bb cc...cc dd...dd*	Details *aa...aa*: Maintenance information *bb...bb*: Error number of the Windows API (hexadecimal number) *cc...cc* and *dd...dd*: Fixed to 0 (hexadecimal number) *ee...ee*: The command that could not be executed, and the registry key that could not be obtained. Action None

9.11 Messages from the dlmpr Utility for Canceling the HDLM Persistent Reserve

Message ID	Message	Details and Actions
KAPL10640-I	The dlmpr utility completed normally.	Details The dlmpr utility for canceling the HDLM persistent reserve finished normally. Action None. For details on the `dlmpr` utility, see section 8.3.
KAPL10644-W	The specified parameters cannot be specified at the same time. parameter = *aa...aa*	Details *aa...aa*: Specified parameter (character string) Action Execute the dlmpr utility with the `-h` parameter to check the parameter, and then retry. For details on the `dlmpr` utility, see section 8.3.
KAPL10646-W	A parameter is invalid. parameter = *aa...aa*	Details *aa...aa*: Specified parameter (character string) Action Execute `help` for the dlmpr utility to check the parameters that can be specified, and then retry. For details on the `dlmpr` utility, see section 8.3.
KAPL10648-E	An internal error occurred in the dlmpr utility. Error Code = *aa...aa*	Details *aa...aa*: Error number (character string) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `dlmpr` utility, see section 8.3.
KAPL10651-I	The user terminated the operation.	Action None.
KAPL10652-E	The entered value is invalid. The operation stops	Details An invalid response to a request was incorrectly entered three times consecutively. Action Re-execute the dlmpr utility.
KAPL10653-W	The entered value is invalid. Please Re-enter it [y/n]:	Action Enter `y` or `n`.
KAPL10654-W	The parameter (*aa...aa*) cannot be specified alone.	Action Specify the correct value for the parameter, and then retry.
KAPL10655-I	Specify the PathID of the LU for which you want to clear persistent reservation information. (To cancel, press the x key):	Action Enter the path ID of the LU for which you want to clear persistent reservation information, and then press the Enter key or enter `n` to cancel.

Message ID	Message	Details and Actions
KAPL10656-I	The persistent reservation information of PathID = *aa...aa* will be cleared. Is this **OK**? [y/n]:	Details We recommend that you report the path ID of the LU for which you want to clear persistent reservation information to the user for confirmation. *aa...aa*: The path ID Action Enter y to execute clearing, or n to cancel.
KAPL10657-I	If you continue this process, the reservation of the LU you specified will be cleared. Please confirm that no other servers are accessing this LU.	Details We recommend that you report the affect of executing the utility to the user again for confirmation. Action Enter y if you really want to execute clearing, or n to cancel.
KAPL10658-I	The persistent reservation information of PathID = *aa...aa* was cleared.	Details *aa...aa*: The path ID Action None.
KAPL10659-I	There is no LU for which persistent reservation information exists.	Action None.
KAPL10660-I	There is no LU managed by HDLM.	Action None.
KAPL10661-E	The SCSI command failed. SCSI Code = *aa...aa*, Service Action = *bb...bb*, Status Code = *cc...cc*, Error Code = *dd...dd*, LU = *ee...ee*	Details *aa...aa*: SCSI Code (hexadecimal number) *bb...bb*: Service Action (hexadecimal number) *cc...cc*: Status Code (hexadecimal number) *dd...dd*: Error code for Windows *ee...ee*: LU Number (character string) Action If the following two conditions are satisfied, contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. ■ The service and the driver of the cluster system are running. ■ An LU was disconnected from the server during execution of a utility.
KAPL10662-E	Free memory is insufficient.	Action Terminate unnecessary applications. If the problem persists, restart the host, and then retry. Alternatively, in dlmpr.exe, specify only the connected LUs for which you want to clear persistent reservation information.
KAPL10663-W	The input value is invalid. Specify the PathID of the LU for you want to clear persistent reservation information. (To cancel: press the x key):	Action Enter a path ID displayed in the list to continue processing, or enter x to cancel.

Message ID	Message	Details and Actions
KAPL10664-E	An attempt to acquire Inquiry data failed. PortNo = *aa...aa*, Error Code = *bb...bb*	Details An error occurred in the issuing of IOCTL_SCSI_GET_INQUIRY_DATA for a SCSI controller. Port No is the number of the port of the SCSI controller to which IOCTL_SCSI_GET_INQUIRY_DATA is issued. *aa...aa*: PortNo (hexadecimal number) *bb...bb*: Error Code (hexadecimal number) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL10665-I	The dlmpr utility completed.	Action None. For details on the dlmpr utility, see section 8.3.
KAPL10666-I	There is no persistent reservation information for the LU of PathID = *aa...aa*. The clear processing will not be executed.	Details *aa...aa*: The path ID of the LU specified by the user. Action None.
KAPL10667-C	An attempt to the get physical drive number failed. LU = *aa...aa*	Details An LU without a physical drive number existed. *aa...aa*: LU number Action If the following condition is satisfied, contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. The service and the driver of the cluster system are running.
KAPL10668-E	An attempt to open a device failed. DeviceName = *aa...aa*	Details *aa...aa*: Device name(character string) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL10669-W	The utility for clearing HDLM persistent reservation (dlmpr) cannot be executed because HDLM is installed.	Action The dlmpr utility can be executed only when the persistent reservation remains after HDLM is uninstalled. To execute the dlmpr utility, uninstall HDLM, and then reboot the host.

9.12 Messages from the HDLM Remote Access Interface

Message ID	Message	Details and Actions
KAPL11901-I	*aa...aa* has started.	Details The operation has started on the host. *aa...aa*: Operation (character string) ■ Get Path Information ■ Get Option Information ■ Set Option Information ■ Clear Data ■ Get HDLM Manager Status ■ Get HDLM Driver Status ■ Get HDLM Alert Driver Status Action None.
KAPL11902-I	*aa...aa* has started. PathID = *bb...bb*	Details The operation has started on the host. *aa...aa*: Operation (character string) ■ Online ■ Offline *bb...bb*: The Path ID of the target path for the operation. (decimal number) Action None.
KAPL11903-I	*aa...aa* has completed normally.	Details Operation has completed normally on the host. *aa...aa*: Operation (character string) ■ Get Path Information ■ Get Option Information ■ Set Option Information ■ Clear Data ■ Get HDLM Driver Status ■ Get HDLM Manager Status ■ Get HDLM Alert Driver Status ■ Online ■ Offline ■ Get SNMP Trap Information ■ Set SNMP Trap Information ■ Set LU Load Balance Action None.

Message ID	Message	Details and Actions
KAPL11904-E	*aa...aa* has completed abnormally. Error status = *bb...bb*	Details Operation has completed abnormally on the host. *aa...aa*: Operation (character string) ■ Get Path Information ■ Get Option Information ■ Set Option Information ■ Clear Data ■ Get HDLM Driver Status ■ Get HDLM Manager Status ■ Get HDLM Alert Driver Status ■ Online ■ Offline ■ Get SNMP Trap Information ■ Set SNMP Trap Information ■ Set LU Load Balance *bb...bb*: Error-status-returned-from-API (character string) Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL11905-E	An unexpected error occurred.	Details An exception occurred during processing in the host. Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM. For details on the DLMgetras utility, see section 8.2.
KAPL11906-I	GUI information - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: Trace information (character string) Action None.
KAPL11907-I	XML reception - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: XML information (character string) Action None.

Message ID	Message	Details and Actions
KAPL11908-I	XML transmission - *aa...aa*	Details This information is required for determining the cause of the problem (if any). *aa...aa*: XML information (character string) Action None.

9.13 Messages from the dlmprsvkey Utility for Registration of the HDLM Persistent Reserve

Message ID	Message	Details and Actions
KAPL12101-W	A parameter has not been specified.	Action Make sure that the parameters for the `dlmprsvkey` utility for registering HDLM persistent reservation key are appropriate, and then try again. For details on the `dlmprsvkey` utility, see section 8.4.
KAPL12102-W	There are too many parameters	Action Make sure that the parameters for the `dlmprsvkey` utility for registering HDLM persistent reservation key are appropriate, and then try again. For details on the `dlmprsvkey` utility, see section 8.4.
KAPL12103-W	The parameter value is invalid. (value = *aa...aa*)	Details The first parameter must be `-r`, `-v`, or `-h`. When the `-r` parameter is specified, the second parameter must be the `-s` parameter or must have 16 digits and be hexadecimal. When the `-h` parameter is specified, values other than the `-h` parameter cannot be entered for the parameter. *aa...aa*: Invalid parameter (character string) Action Make sure that the parameters for the `dlmprsvkey` utility for registering HDLM persistent reservation key are appropriate, and then try again. For details on the `dlmprsvkey` utility, see section 8.4.
KAPL12104-I	The operation for PRSV key registration will now start. Is this OK? [y/n]:	Details The operation for PRSV key registration will now start. To continue, enter `y`. To cancel, enter `n`. Action To execute the operation, enter `y`. To stop the operation, enter `n`.

Message ID	Message	Details and Actions
KAPL12105-W	The user does not have permission to execute the utility for registering HDLM persistent reservation key.	Details The dlmprsvkey utility for registering HDLM persistent reservation key must be executed by a user with administrator privileges. Action Try again as a user with administrator privileges. For details on the dlmprsvkey utility, see section 8.4.
KAPL12106-I	An attempt to register the PRSV key was successful. (PRSV key = *aa...aa*)	Details *aa...aa*: PRSV key (character string) Action None.
KAPL12107-W	An attempt to register the PRSV key has failed. (PRSV key = *aa...aa*)	Details *aa...aa*: PRSV key (character string) Action Check whether HDLM has been installed correctly. If it has, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL12108-I	The utility for registering the HDLM persistent reservation key finished due to a user specification.	Details Processing of the dlmprsvkey utility for registering HDLM persistent reservation key will now stop, because n was returned as the confirmation response. Action None. For details on the dlmprsvkey utility, see section 8.4.
KAPL12110-W	The entered value is invalid. Processing of the utility for registering the HDLM persistent reservation key will now terminate.	Details Processing of the dlmprsvkey utility for registering HDLM persistent reservation key will now stop, because an incorrect response was made three times for the response request. Action Re-execute the dlmprsvkey utility. For details on the dlmprsvkey utility, see section 8.4.
KAPL12111-E	The registry key for the registration destination does not exist.	Details The registry key HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HDLMdsm\Parameters\PRSVKeyString does not exist. Action Check whether HDLM has been installed correctly. If it has, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

Message ID	Message	Details and Actions
KAPL12112-E	An error occurred during internal processing of the utility for registering the HDLM persistent reservation key . Details = *aa...aa*, *bb...bb*	Details An error, probably not caused by the user, occurred during processing of the dlmprsvkey utility for registering HDLM persistent reservation key. *aa...aa*: Error detail *bb...bb*: Error Code (character string) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the dlmprsvkey utility, see section 8.4.
KAPL12113-E	An attempt to acquire the PRSV key has failed.	Details An attempt to acquire the PRSV key from the registry key HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HDLMdsm\Parameters\PRSVKeyString while -v was specified has failed. Action If the PRSV key was not registered using the dlmprsvkey utility, register the PRSV key, and then re-execute the utility with the -v option. If the PRSV key has been registered, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the dlmprsvkey utility, see section 8.4.
KAPL12114-E	An invalid PRSV key has been registered.	Details An invalid PRSV key has been entered in HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HDLMdsm\Parameters\PRSVKeyString. Action Execute the dlmprsvkey utility for registering HDLM persistent reservation key to register a valid PRSV key.
KAPL12115-E	An attempt to generate the PRSV key has failed.	Action Specify the -r parameter for the PRSV key, and then try again. For details on the dlmprsvkey utility, see section 8.4.
KAPL12116-I	The registered PRSV key will now be displayed. (PRSV key = *aa...aa*)	Details The PRSV key registered in HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HDLMdsm\Parameters\PRSVKeyString will now be displayed. *aa...aa*: PRSV key Action None.

Message ID	Message	Details and Actions
KAPL12117-I	Trace data for maintenance: registered PRSV key = *aa...aa*	Details Output when PRSV key registration is successful. *aa...aa* contains the PRSV key (hexadecimal number). Message for trace logs. Action None.
KAPL12118-E	Trace data for maintenance: *aa...aa bb...bb cc...cc dd...dd*	Details This message is for trace logs when an error occurs: ■ before the PRSV key is generated when `-r` is specified, or ■ before the PRSV key is acquired when `-v` is specified. *aa...aa*: Maintenance information 1 (hexadecimal number) *bb...bb*: Maintenance information 2 (hexadecimal number) *cc...cc*: Maintenance information 3 (hexadecimal number) *dd...dd*: Maintenance information 4 (hexadecimal number) Action None.
KAPL12119-E	Trace data for maintenance: *aa...aa bb...bb cc...cc dd...dd ee...ee*	Details This message is for trace logs when an error occurs: ■ after the PRSV key is generated when `-r` is specified, or ■ after the PRSV key is acquired when `-v` is specified. *aa...aa*: Maintenance information 1 (hexadecimal number) *bb...bb*: Maintenance information 2 (hexadecimal number) *cc...cc*: Maintenance information 3 (hexadecimal number) *dd...dd*: Maintenance information 4 (hexadecimal number) *ee...ee*: PRSV key (hexadecimal number) Action None.

9.14 Messages from the HDLM Performance Monitor

Message ID	Message	Details and Actions
KAPL12150-E	An error occurred during internal processing of HDLM Performance Monitor. HDLM Performance Monitor cannot start. Details = *aa...aa*	Details An attempt to start HDLM Performance Monitor has failed. *aa...aa*: Error details (character string) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL12151-E	A Windows Management Instrumentation service access error occurred. Details = *aa...aa*, *bb...bb*	Details A Windows Management Instrumentation service access error occurred. *aa...aa*: API name (character string) *bb...bb*: Error code (decimal number) Action Check whether the Windows Management Instrumentation service is working. If it is not, start it. If the service cannot be started or if the problem is not solved even after restarting the service, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL12152-E	An error occurred during internal processing of HDLM Performance Monitor. Details = *aa...aa*, *bb...bb*	Details An error, probably not caused by a user operation, occurred during Performance Monitor processing. *aa...aa*: Internal processing name (character string) *bb...bb*: Error code (decimal number) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

9.15 Messages from the dlmchkpath Utility for Checking HDLM Paths

Message ID	Message	Details and Actions
KAPL12401-I	All LUs managed by HDLM are in a single path configuration.	Details This message is displayed when the number of LUs managed by HDLM is 0. Action None.
KAPL12402-W	iLU (*aa...aa*) is in a multi-path configuration. PathID = *bb...bb*[,*cc...cc*]...	Details The LU of the LU number in the message is not in a single path configuration. *aa...aa*: LU number *bb...bb,cc...cc*: Path ID of the path connected to the LU Action Before performing uninstallation, upgrade installation, or re-installation, change the LUs to a single path configuration.
KAPL12403-W	A necessary parameter has not been specified.	Action Execute the `dlmchkpath` utility with the -h parameter to check the parameter, and then retry. For details on the `dlmchkpath` utility, see section 8.5.
KAPL12404-W	A parameter is invalid. Parameter = *aa...aa*	Details *aa...aa*: Specified parameter Action Execute the `dlmchkpath` utility with the -h parameter to check the parameter, and then retry. For details on the `dlmchkpath` utility, see section 8.5.
KAPL12405-E	Cannot execute the utility for checking HDLM paths due to insufficient memory.	Details The memory required for processing the dlmchkpath utility could not be allocated. Action Terminate unnecessary applications to increase the amount of free memory. Alternatively, restart the host.

Message ID	Message	Details and Actions
KAPL12406-E	An error occurred in internal processing of the utility for checking HDLM paths. Error code = *aa...aa*, details code = *bb...bb*	Details *aa...aa*: Error code *bb...bb*: Details code Action ■ Error code: 22 Check whether HDLM has been installed correctly. If it has, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. ■ Error code: Others Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

9.16 Return Codes for the HDLM Remote Access Interface

The HDLM remote access interface is an interface used by other HiCommand products to access hosts. HDLM outputs a return code when the operation that the HDLM remote access interface requested to HDLM terminates abnormally, or when there is a warning while the operation terminates normally.

Return Code	Details and Actions
1002	Details There is no path on which the operation can be performed. Action Refresh the host information, check the path status, and then perform the operation again.
1003	Details No path was detected. Action Check whether a path between the host and the storage system is connected. If a path is connected, check whether HDLM is configured correctly.
1004	Details Memory required for HDLM internal processing could not be allocated. Action Terminate unnecessary applications to increase free memory, or restart the host.
1006	Details The Offline path cannot be placed Online. Action Remove the error in the path, and then retry.
1007	Details The target path of the offline operation is the last path of the device and cannot be placed in the offline status. Action Click Refresh to update the host information, check the path status, and then retry the offline operation.
1015	Details The Offline path cannot be placed Online. Action Remove the error in the path, and then retry.
1016	Details The target path(s) are already Online. Action Update the host information, and then check the path status.
1017	Details The target path(s) are already Offline(C). Action Update the host information, and then check the path status.

Return Code	Details and Actions
1018	Details The load balancing function is not supported because MSCS is installed. Action The load balancing function is not supported in an environment with MSCS installed. If you want to use the load balancing function, uninstall MSCS from the host.
1019	Details An error occurred during HDLM internal processing. Action Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.
1020	Details An unexpected error occurred during HDLM internal processing. Action Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.
1021	Details MSCS is not installed on the host. Action Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.
1022	Details Batch registration of Offline processing was performed. Action Refresh the host information, and then check the path status.
1023	Details Batch registration of Offline processing has already been performed. Action Refresh the host information, and then check the path status.
1024	Details The configuration does not support the simultaneous use of the load balancing and cluster support functions. Action Make sure that all HDLM-managed storage systems support persistent reservation on the host. Contact your storage system vendor or maintenance company to check whether the storage systems you are using support persistent reservation.
1025	Details A parameter value is invalid. Action Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras` utility, see section 8.2.

Return Code	Details and Actions
1026	Details The getting Path Information has been stopped because the configuration of paths was changed during the processing of the getting Path Information. Action Refresh the host information, check the path status, and then perform the operation again.
1027	Details The error monitoring interval and the number of times that the error is to occur conflict with the automatic failback checking interval. Action Set the monitoring interval to a value that is equal to or more than (auto failback checking interval x number of times).
1033	Details An attempt to acquire the HDLM version information failed. Action Re-execute. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details, see section 8.2.
1034	Details An attempt to acquire information about the HDLM version or SP version has failed. Action Re-execute. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details, see section 8.2.
1035	Details An attempt to acquire information about the HDLM version or SP version has failed. Action Re-execute. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details, see section 8.2.
1036	Details An attempt to acquire information about the HDLM version or SP version has failed. Action Re-execute. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details, see section 8.2.
1037	Details A parameter value is invalid. Action Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details, see section 8.2.

Return Code	Details and Actions
1038	Details A storage system that cannot use the load balancing function is connected. Action Please check a system configuration. One or more connected storage system(s) cannot use the load balancing function. The load balancing function does not operate on the LUs of that storage system.
1041	Details An attempt to communicate with the HDLM Manager has failed. Action Check whether the HDLM Manager is running on the host. If it is not running, start the HDLM Manager.
1042	Details Information about the path configuration on the specified LU does not match the path configuration information held by HDLM. Action Refresh the host information, check the path status, and then perform the operation again.
1043	Details The specified LU is an LU of a storage system that cannot use the load balancing function. Action Check the storage system of the LU connected by the specified path.
1045	Details A parameter value is invalid. Action Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details, see section 8.2.
1046	Details A parameter value is invalid. Action Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details, see section 8.2.

Appendix A Functionality Differences Between HDLM Versions

A.1 Functionality differences between version 5.9.1 and versions earlier than 5.9.1

- In HDLM 5.9.1, the initial window of the Path Management window of the HDLM GUI has been changed from the **Configuration** view to the **Path List** view.

A.2 Functionality differences between version 5.9 and versions earlier than 5.9

- In HDLM 5.9, the function for remotely operating HDLM from HDLM GUI or HDLM Web GUI by linking with HiCommand Device Manager is no longer supported.
- In HDLM 5.9, the `DLMgetras` utility can be started from the Windows **Start** menu.

A.3 Path Status Transition and Automatic Path Switching

A.1.1 Status Transition of Paths in the Online Status

In HDLM 5.5 or later, if one of the following conditions exists, the status of Online paths will change to Online(E) or Offline(E). In HDLM 5.4 or earlier, even if one of the following conditions exists, the path status remains Online.

- A path disconnection that is free from I/O errors has occurred
- An LU has been removed from being an HDLM management-target

A.1.2 Automatic Switching of Paths that Have the Online(E), Offline(C), or Offline(E) Status

In HDLM 5.5 or later, if one of the following conditions exists, the status of Online(E), Offline(C), or Offline(E) paths will automatically change to Online. In HDLM 5.4 or earlier, even if one of the following conditions exists, the path status does not automatically change to Online.

- Online(E) Paths

  If one of the following conditions exists, Online(E) paths will automatically change to Online.

  - A path disconnection that is free from I/O errors has been recovered.
  - An LU was removed from being an HDLM management-target and then the LU was added as an HDLM management-target again.

- Offline(C) Paths

  When the following conditions are satisfied, the connected Offline(C) paths are automatically placed Online:

  - All the online paths are Online(E) and SCSI devices connected to the Online(E) paths have been deleted.

- SCSI devices are connected and all Offline(E) paths are subject to automatic failback.
- SCSI devices are connected to the Offline(C) paths.

- Offline(E) Paths, where intermittent errors are thought to have occurred

  When the following conditions are satisfied, the connected Offline(E) paths are automatically placed Online:

  - All the online paths are Online(E) and SCSI devices connected to the Online(E) paths have been deleted.
  - The SCSI devices are connected to the Offline(E) paths.

- Offline(E) Paths, where intermittent errors are not thought to have occurred

  If one of the following conditions exists, Online(E) paths will automatically change to Online.

  - A path disconnection that is free from I/O errors has been recovered
  - An LU was removed from being an HDLM management-target and then the LU has been added as an HDLM management-target again

A.2 Differences in LU Dynamic Removal Functionality

Depending on the HDLM version, LU dynamic removal functionality differs as follows:

- In HDLM 5.2 or 5.4
  - When **Remove the LU even if there are Offline(C) paths** is not specified (or when the following HDLM command is executed: `dlnkmgr set -rmlu on`)

    If none of the paths connected to the LU is Online or Offline(C), the LU will be removed from being an HDLM management-target.
  - When **Remove the LU even if there are Offline(C) paths** is specified (or when the following HDLM command is executed: `dlnkmgr set -rmlu on -force`)

    If none of the paths connected to the LU is Online, the LU will be removed from being an HDLM management-target.
- In HDLM 5.5 or later
  - When **Remove the LU even if there are Offline(C) paths** is not specified (or when the following HDLM command is executed: `dlnkmgr set -rmlu on`)

    If none of the paths connected to the LU is Online or Offline(C), the LU will be removed from being an HDLM management-target.

    However, if one of the following conditions exists, the LU will not be removed from being an HDLM management-target:

    When an Offline(E) path connected to the LU satisfies the conditions for automatically switching to Online. For details about these conditions, see section D.1.2.

    When Offline(C) paths are disconnected and changed to Offline(E) by an online operation, and then no path is Online
  - When **Remove the LU even if there are Offline(C) paths** is specified (or when the following HDLM command is executed: `dlnkmgr set -rmlu on -force`)

    If none of the paths connected to the LU is Online, the LU will be removed from being an HDLM management-target. However, the LU will not be removed if any Offline(E) or Offline(C) path satisfies the conditions for automatically switching to Online. For details about these conditions, see section D.1.2.

A.3 Differences in Drive Letters Displayed in Windows

Depending on the HDLM version, the Windows drive letters (displayed when all paths connected to the LU have an error status) differ as follows:

- When the LU dynamic removal functionality is not used in HDLM 5.4

  Drive letters are displayed for the disks that are displayed in **My Computer**.
- When the LU dynamic removal functionality is used in HDLM 5.4, 5.5 or later, or when the functionality is not used in HDLM 5.5

  Drive letters are not displayed for the disks that are displayed in **My Computer**.

A.4 Differences in Default Values

Depending on the HDLM version, default values for the HDLM functionality differ as follows:

- Default value for path health checking
  - In HDLM 4.0 or earlier: OFF
  - In HDLM 5.0 or later: ON. The checking interval is 30 minutes.
- Default value for error log file size
  - In HDLM 5.4 or earlier: 1000 KB. Note that this item name in HDLM 5.4 or earlier is **Log file size**.
  - In HDLM 5.4 or later: 9900 KB

A.5 Differences in Load Balancing Functionality in an MSCS Environment

HDLM 5.0 or earlier does not support the load balancing functionality in an MSCS environment. Therefore, when you use HDLM 5.0 or earlier in an MSCS environment, even if you set the load balancing functionality to ON, it will automatically change to OFF.

Acronyms and Abbreviations

AL	arbitrated loop
API	application programming interface
BIOS	basic input/output system
CA	channel adapter
CCI	command control interface
CHA	channel adapter
CL	cluster
CLPR	cache logical partition
CS	cluster support
CSV	comma separated value
CU	control unit
DEV	device
EMC CX series	EMC CLARiiON CX series
EMC DMX series	EMC Symmetrix DMX series
HDLM	HiCommand Dynamic Link Manager
HDLM GUI	Windows application GUI
HLU	host logical unit
I/O	input/output
IA32	Intel Architecture 32
IP	Internet protocol
IPF	Itanium Processor Family
iSCSI	Internet small computer system interface
JRE	Java 2 Runtime Environment, Standard Edition
Java Web Start	Java Web Start
LAN	local-area network
LB	load balancing
LU	logical unit
LUN	logical unit number
MPIO	Multipath I/O
MSCS	Microsoft Cluster Server A cluster service contained in Microsoft Windows 2000 Datacenter Server Operating System, Microsoft Windows 2000 Advanced Server Operating System, Microsoft Windows Server 2003 Datacenter Edition, Microsoft Windows Server 2003 Datacenter Edition for Itanium-based Systems, Microsoft Windows Server 2003 Datacenter x64 Edition, Microsoft Windows Server 2003 Enterprise Edition, Microsoft Windows Server 2003 Enterprise Edition for Itanium-based Systems, Microsoft Windows Server 2003 Enterprise x64 Edition, Microsoft Windows Storage Server 2003 Enterprise Edition, and

	Microsoft Windows Storage Server 2003 Enterprise x64 Edition
MVS	multiple virtual storage
NIC	network interface card
OS	operating system
P	port
PRSV	persistent reserve
SAN	storage-area network
SCSI	small computer system interface
SLPR	storage logical partition
SNMP	simple network management protocol
SVS	HP StorageWorks 200 Storage Virtualization System
TID	target ID
VSFW	Veritas Storage Foundation for Windows
VxVM	Veritas volume manager
Windows 2000 Server	A generic term for Microsoft Windows 2000 Server Operating System, Microsoft Windows 2000 Advanced Server Operating System, and Microsoft Windows 2000 Datacenter Server Operating System
Windows Server 2003	A generic term for Windows Server 2003 (IA32), Windows Server 2003 (IPF), or Windows Server 2003 (x64) Windows Server 2003 (IA32) is a generic term for Microsoft Windows Server 2003, Standard Edition, Microsoft Windows Server 2003, Web Edition, Microsoft Windows Server 2003 Datacenter Edition, Microsoft Windows Server 2003 Enterprise Edition, Microsoft Windows Server 2003 R2, Datacenter Edition, Microsoft Windows Server 2003 R2, Enterprise Edition, Microsoft Windows Server 2003 R2, Standard Edition, Microsoft Windows Storage Server 2003 Enterprise Edition, Microsoft Windows Storage Server 2003, Standard Edition, Microsoft Windows Storage Server 2003 R2, Enterprise Edition, Microsoft Windows Storage Server 2003 R2, Express Edition, Microsoft Windows Storage Server 2003 R2, Standard Edition, or Microsoft Windows Storage Server 2003 R2, Workgroup Edition Windows Server 2003 (IPF) is a generic term for Microsoft Windows Server 2003 Datacenter Edition for Itanium-based Systems or Microsoft Windows Server 2003 Enterprise Edition for Itanium-based Systems Windows Server 2003 (x64) is a generic term for Microsoft Windows Server 2003 Datacenter x64 Edition, Microsoft Windows Server 2003 Enterprise x64 Edition, Microsoft Windows Server 2003 R2, Datacenter x64 Edition, Microsoft Windows Server 2003 R2,

	Enterprise x64 Edition, Microsoft Windows Server 2003 R2, Standard x64 Edition, Microsoft Windows Server 2003 Standard x64 Edition, Microsoft Windows Storage Server 2003 R2, Enterprise x64 Edition, Microsoft Windows Storage Server 2003 R2, Express x64 Edition, Microsoft Windows Storage Server 2003 R2, Standard x64 Edition, Microsoft Windows Storage Server 2003 R2, Workgroup x64 Edition, Microsoft Windows Storage Server 2003 Enterprise x64 Edition, or Microsoft Windows Storage Server 2003 Standard x64 Edition
Windows Server 2003 R2	A generic term for Microsoft Windows Server 2003 R2, Datacenter Edition, Microsoft Windows Server 2003 R2, Datacenter x64 Edition, Microsoft Windows Server 2003 R2, Enterprise Edition, Microsoft Windows Server 2003 R2, Enterprise x64 Edition, Microsoft Windows Server 2003 R2, Standard Edition, Microsoft Windows Server 2003 R2, Standard x64 Edition, Microsoft Windows Storage Server 2003 R2, Enterprise Edition, Microsoft Windows Storage Server 2003 R2, Enterprise x64 Edition, Microsoft Windows Storage Server 2003 R2, Express Edition, Microsoft Windows Storage Server 2003 R2, Express x64 Edition, Microsoft Windows Storage Server 2003 R2, Standard Edition, Microsoft Windows Storage Server 2003 R2, Standard x64 Edition, Microsoft Windows Storage Server 2003 R2, Workgroup Edition, or Microsoft Windows Storage Server 2003 R2, Workgroup x64 Edition
XP128	HP StorageWorks XP128 Disk Array
XP1024	HP StorageWorks XP1024 Disk Array
XP10000	HP StorageWorks XP10000 Disk Array
XP12000	HP StorageWorks XP12000 Disk Array

Glossary

automatic failback	Functionality for checking the status of paths at regular intervals and automatically placing the status of a path recovered from an error into Online status. If a path with Offline(E) or Online(E) status recovers from an error, automatic failback places the path Online. Automatic failback checks the status of paths that were placed in Offline(E) or Online(E) status because of an error, but does not check the status of paths that were placed in Offline(C) status by executing the `offline` operation.
AutoPATH_ID	An ID that HDLM assigns to a path at system startup. Every path has a unique AutoPATH_ID.
boot disk environment	An environment in which the startup disk is in a storage system instead of in the host.
CHA (channel adapter)	An adapter for controlling a storage system channel.
CLPR(cache logical partition)	A function, supported by the TagmaStore USP and Universal Storage Platform V, for logically splitting a cache. This function splits the cache by array groups in the storage system, so that other array groups do not affect cache performance.
cluster	A system that connects multiple hosts having the same operating system or platform (that is, an environment in which the same application can run) and treats them as one system.
dev	A logical division of an LU that HDLM controls and operates. A dev is equivalent to a partition in Windows. In a Windows, each LU has only one dev, and each dev has a dev number.
dev number	A dev number (DNum column) in the configuration list in HDLM. `0` is displayed. This number indicates the entire LU. HDLM operates assuming that one LU has one dev, so the dev number is fixed to 0.

dynamic reconfiguration	Dynamic reconfiguration enables HDLM to recognize devices whose configuration has been changed without restarting the host using Windows plug and play functionality.
emulation type	An LU type accessible from a host. Since an HDLM host is an open-system host such as a PC or a UNIX machine, the HDLM host can access only LUs with open-system emulation types. For details on emulation types supported by a storage system, see the maintenance manual for that storage system.
failback	Functionality for placing the status of a path recovered from an error into Online status, and switching the access path to the recovered path.
failover	Functionality for switching to another normal path if there is an error in a path, thereby enabling a system to continue to operate.
FC-SAN (fibre channel - storage area network)	A SAN using a fibre channel. Though FC-SAN is synonymous with SAN, it is called an FC-SAN to distinguish it from an IP-SAN.
HBA (host bus adapter)	A device that functions as an interface connecting hosts and external devices. In this manual, the term HBA indicates an interface card that is mounted on a host when the host connects to a storage system via a SCSI or FC connection.
HDLM alert driver	A program that receives information about an error detected by the HDLM driver and then reports the error information to the HDLM manager.
HDLM driver	A program that controls the HDLM functionality, manages paths, and detects errors.
HDLM manager	A program that manages error information. The HDLM manager receives the error information from the HDLM alert driver and then collects error logs.
Host	A generic name for both servers and clients.
host device	A device within a host LU.

host device name	A logical area within a host LU.
host LU	An LU that the host recognizes. The actual HDev entity is a dev in the storage system. Each host LU has a host LU number.
host LU number	A number assigned to a host LU. The host LU number is part of a path name.
IP-SAN (Internet protocol - storage area network)	A data transfer network that connects hosts and storage systems using the iSCSI standard.
LDEV (logical device)	The value that identifies an LDEV consists of a combination of the storage system's product name, serial number, and internal LU. HDLM uses this value to identify an LU.
load balancing	Functionality for distributing the load across the paths that access each logical area within an LU. To distribute loads, load balancing uses multiple paths to perform I/O operations. Two types of algorithms are available: round-robin and extended round-robin.
LU (logical unit)	A logical unit that is a logical volume defined in the storage system, and with which the host can perform input or output operations.
node	A server of cluster members.
non-owner controller	A controller that provides slower LU accesses than an owner controller. Non-owner controllers exist only when Thunder 9200 or Thunder 9500V Series are in use.
non-owner path	A path that provides slower LU accesses than an owner path. Non-owner paths use a non-owner controller. Non-owner paths exist only when Thunder 9200, or Thunder 9500V Series are in use.
owner controller	A controller that provides the fastest access to an LU. When using the Thunder 9200, or Thunder 9500V Series, the access speed to the LU varies depending on the controller. A controller that provides slower LU access than an owner controller is called a non-owner controller. When using the TagmaStore USP, Lightning 9900V Series, or Lightning 9900 Series, TagmaStore USP, or

	Universal Storage Platform V, all controllers are owner controllers.
owner path	A path that provides the fastest access to an LU, using an owner controller. When using the Thunder 9200, or Thunder 9500V Series, the access speed to the LU varies depending on the path. A path that provides slower LU accesses than the owner path is called a non-owner path.When using the TagmaStore USP, Lightning 9900V Series, and Lightning 9900 Series, TagmaStore USP, or Universal Storage Platform V, all paths are owner paths.
path	An access path from a host to storage system. Access to a logical area within an LU in a storage system is made via a cable connecting the host bus adapter on the host and the channel adapter on the storage system. Each path has an AutoPATH_ID.
path health checking	Functionality for checking the status of paths at regular intervals. When an error occurs at a path that was in the Online status, path health checking changes the status of the path to the Offline(E) status. Path health checking checks only those paths that have Online status.
path name	The name of a path, which consists of the following four hexadecimal items, separated by periods: a host port number, a bus number, a target ID, and a host LU number.
persistent reservation	Similar to reservation, persistent reservation enables a host to declare that it has exclusive use of an LU, and prevents other hosts from accessing that LU. While reservation allows a host to have exclusive use of only one path to the LU, persistent reservation allows a host to have exclusive use of multiple paths. If HDLM applies persistent reservation, a host can have exclusive use of multiple paths to an LU, thus enabling load balancing among these exclusively used paths.
physical path	An access path from a host to an LU. A path name is used to identify a physical path.
Remove LU	Functionality to delete LU from an HDLM

	target host when an LU is deleted or all paths connected to the LU are placed in Offline(E) status.
reservation	The reservation functionality enables a host to declare that it has exclusive use of an LU, thus preventing other hosts from accessing that LU. Access permission for a reserved LU is given only to the host that issued the reservation, so the LU cannot be accessed from multiple paths simultaneously. As a result, load balancing is not possible.
SAN (storage area network)	A high-speed network connecting hosts and storage systems. This network is independent of a LAN and is dedicated to data transfer. A SAN provides faster accesses to storage systems, and prevents the transfer of high-volumes of data from deteriorating LAN performance.
SLPR(storage logical partition)	A function, supported by the TagmaStore USP, and Universal Storage Platform V, for logically splitting a storage system. This function splits the resources (ports, CLPR, and volumes) in the storage system, so that the user can manage each resource independently.

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